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# NEW ENGLAND POPULATION AND LABOR FORCE PROJECTIONS

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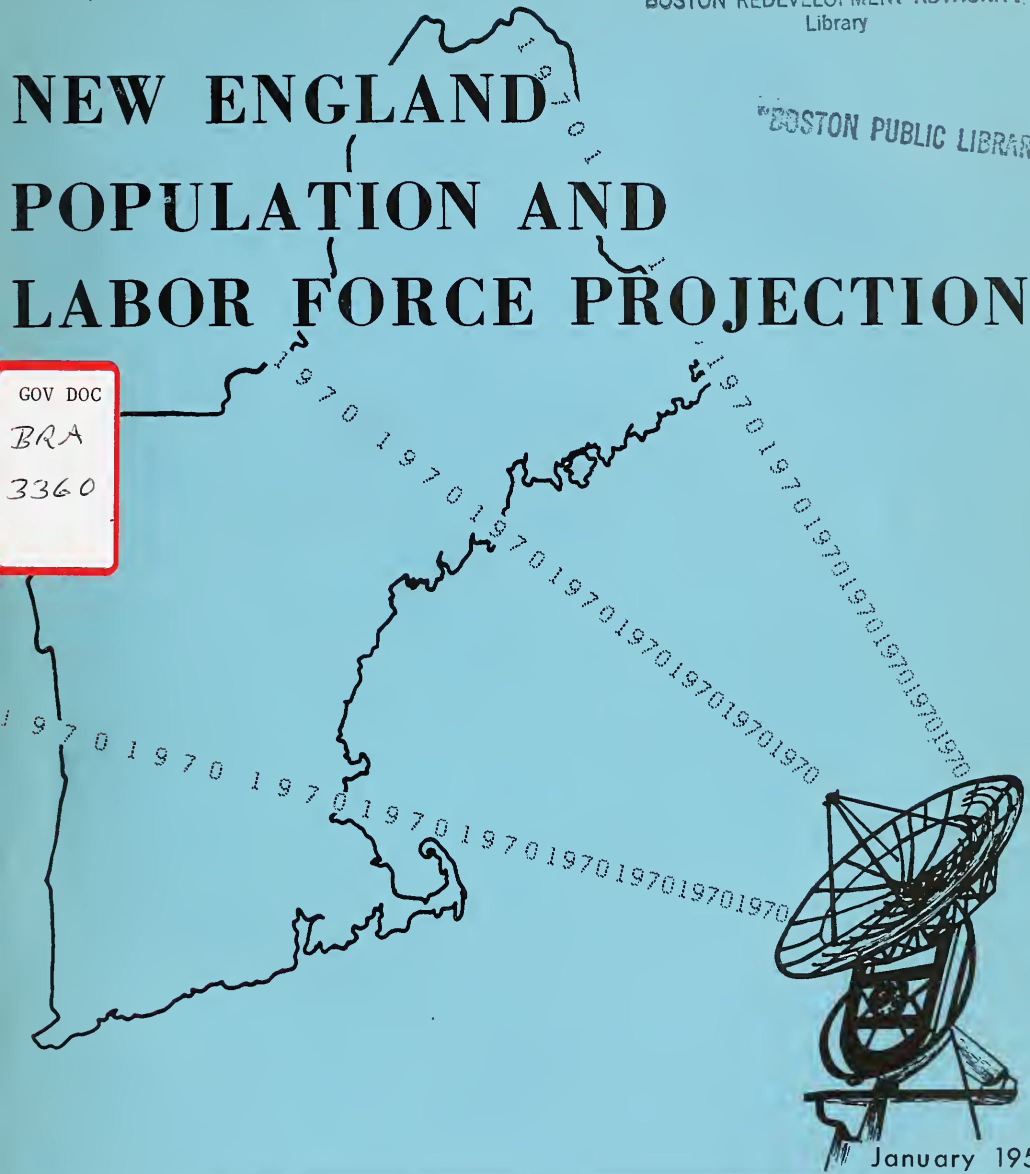

January 1959

Research Report
Federal Reserve Bank
of Boston
1970 Projection No. 5

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# INTRODUCTION

This report presents projections of population and labor force by age and sex for the six New England States to 1960 and 1970 and describes the techniques and procedures used in developing the projections. The report is divided into two parts, Part I dealing with Population Projections and Part II with Labor Force Projections.

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# PART I. POPULATION PROJECTIONS

## A. Preliminary Considerations

The projection of present populations into the future is, at best, an exceedingly hazardous undertaking, since the several basic factors determining future populations (mortality, fertility and migration) are all undergoing change - sometimes rapid change. The inaccuracies of projections of United States population made in the past admirably illustrate how gross the errors may become.[1] For example, the December, 1958 population of continental United States is, in round numbers, 175 million.[2] Yet in 1947, P.K. Whelpton published an estimate of only 156 million for 1960.[3] The projection period is only 13 years, yet the actual population today exceeds the forecast for 1960 by more than 12 percent. Of course, Whelpton was working late in an intercensal period, and he had no means of foreseeing the radical alteration in American fertility patterns which was only beginning to take shape in 1947. But the projections described in this paper have also been developed late in an intercensal period, and although the projection span--to 1970--is only a little more than 11 years, contrasted to Whelpton's 13, any advantage deriving from the shorter time span is more than offset by the inherent difficulties of working with state rather than national populations. These greater difficulties stem from the obvious fact that fertility, mortality and migration are more variable for individual states than for the nation as a whole - a

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1/ cf. Warren Thompson, Population Problems, 4th ed., New York, 1953, Table 18-2, p. 366 for several samples.

2/ Current Population Reports: Population Estimates, Series P-25, No. 192, "Provisional Estimates of the Population of the United States, January 1, 1950, to December 1, 1958", Bureau of the Census, Department of Commerce, Washington, 1959.

3/ P.K. Whelpton, Forecasts of the Population of the United States, 1945-1975, Bureau of the Census, Washington, 1947. Text figures rounded from Thompson, loc. cit.

manifestation of the well known lesser stability of small numbers compared to large. If all other conditions were comparable, populations like those of Maine, New Hampshire, Vermont, and Rhode Island, all of which were under one million in 1950, would be expected to show considerably less stability of growth than the national population of 151 million. But all other conditions are not equal. The migration factor, described in a recent Census Bureau report as playing "...a relatively minor role...as a component of population change in the United States in recent years...",[4/] plays a tremendous part in state population changes. To select only one example, the allowance for out-migration used in the present projections for Vermont, from 1950 to 1970, amounts to more than twenty percent of the state's 1950 population. In sharp contrast the in-migration allowance for the United States used in the Census Bureau's most recent projections[5/] amounts, on a comparable basis, to less than four percent of the nation's 1950 population. To magnify the difficulty even further, national patterns of immigration and emigration are regulated by restrictive laws which tend to hold volume to a fairly stable minimum, whereas migration across state lines is totally unregulated, and ebbs and flows in response to varying local conditions.

This does not mean that reasonably accurate projections of state populations are impossible, but it does mean that the results of any such projections must be understood to be exactly what they are: the end product of a series of involved computations into which many assumptions enter.

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[4/] Meyer Zitter and Jacob S. Siegel, Current Population Reports; Population Estimates, Series P-25, No. 187, "Illustrative Projections of the Population of the United States, By Age and Sex 1960 to 1980", Bureau of the Census, Department of Commerce, Washington, p. 13.

[5/] ibid.

The projections presented in this paper are as reasonable as the assumptions which underlie them but it must be kept in mind that these assumptions as to future events reflect primarily past experience, and can at best only approximate future changes. At worst, some of the basic assumptions, expecially as to fertility and migration, may turn out to have been inappropriate. In using the projections, therefore, due caution should be observed in interpretation, and careful qualification should accompany conclusions drawn. These strictures apply with especial force to the very detailed figures in Tables I-1 through I-6 below. These data are presented in detail for five and ten year age-sex groupings for the limited audience of this technical working paper only. In any publication of results, broader age groupings and rounded figures are essential to avoid the appearance of obviously spurious accuracy.

## B. Projection Method and Assumptions

### Method

The component method of population projection is widely used today because of two important advantages over earlier methods of mathematical extrapolation. First, it permits separate empirical assessments of the major components of population change---fertility, mortality and migration--for the specific population under consideration. Second, because these components all vary with age and sex, it utilizes age-sex distributions in its procedures and produces projections, not merely of totals, but of age-sex groupings. Logically, the method is simple arithmetic: beginning with the known age-sex groupings of a base-line population, estimated numbers of future births are added, estimated numbers of future deaths are subtracted, and estimated numbers of in-or out-migrants are added or subtracted, to generate the projection. As employed in developing the present projections for each of the New England states the procedure can be described as follows.

The most recent available enumeration of population, the 1950 Federal Census, was corrected for underenumeration of 0-4 year olds, and taken as the base population. Survivors of each 5-year age-sex grouping in 1960 were computed by applying ten-year survival rates based on 1949-1951 State Life Tables. Estimated ten-year net migration components based on 1940-1950 experience, modified in the light of 1950-1957 experience, were added to, or subtracted from, the numbers of survivors in each age-sex grouping. The result is the 1960 projection by sex and age for the population aged ten years and older. The 0-4 age groupings were projected by applying the estimated 1955 fertility ratio to the number of women in the child bearing ages (15-44 years) in the projected 1960 population. The projection for ages 5-9 was derived from an estimate of the numbers 0-4 in 1955 (itself based on registered births from 1950 to 1955) by applying five-year survival rates and migration components.

The 1970 projection was similarly developed from the 1960 base, using estimated 1959-1961 survival rates,[6/] migration components assumed appropriate for the 1960-1970 decade,[7/] and the estimated 1955 fertility ratio. Projection figures for age groupings under ten years in 1970 were derived in the same way as for 1960, except that the 1965 estimate of number 0-4 years old (required for completing the 5-9 projection) was computed by linear interpolation between the numbers projected at age 0-4 in 1960 and in 1970; and appropriate five-year survival rates and migration components were used.

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[6/] For a description of the derivation of these rates, see section on procedural details, below.

[7/] For specific migration assumptions, see below, this section.

Assumptions

a. Base Population. It was assumed that the 1950 Federal Census of population provides an accurate tabulation of state populations, by age and sex for April 1, 1950, the Census date, (and the date of the projections), except for the age grouping 0-4 years, which was assumed to be underenumerated, and which was accordingly corrected. This is the conventional assumption for projection work, although it may not be fully justified since some underenumeration in other age categories undoubtedly occurred in the 1950 Census.

b. Mortality (Survival). The mortality, or survival, factor is the most stable of the major components of population change. For the present projections, it was assumed that age--specific mortality--survival from 1950 to 1960 would average out at the levels experienced by the white population in 1949-1951, as described by survival rates based on State Life Tables prepared in the National Office of Vital Statistics.[8/] In effect, this assumes a slight increase in survival (decrease in mortality) for the decade, since it applies the more favorable white rates to the total population, which includes a few nonwhites. For 1960-1970, it was assumed that there would be a small further improvement in survival (decrease in mortality) and accordingly a new set of slightly higher survival rates were estimated for 1959-1961, using national projections prepared by the Federal Security Administration, and adopted by the Census Bureau, as a basis. Based on 1950 population, the adjusted survival rates would have reduced numbers of deaths from 1950 to 1960 by 2-3/4 percent as compared to the 1949-1951 rates.

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[8/] For exact citations, see section on procedural details, below.

c. Fertility. Experience during the last decade and a half has made the variability of the fertility component in population change abundantly clear. Selection of appropriate fertility assumption must therefore rest as much on an assessment of nondemographic factors affecting fertility as on fertility experience itself. Basically, therefore, it is assumed that the changed attitudes toward marriage and parenthood which have induced Americans to marry earlier, and to bear children younger and in larger numbers during the last decade and a half, will continue to be operative at the same levels of intensity until 1970. Specifically it is assumed that fertility will continue to 1970 at levels experienced in 1950-1955 as reflected in the 1955 fertility ratio (# 0-4/ # females 15-44).[9]

d. Migration. The migration factor in population growth is, for populations of smaller areas such as those we are here concerned with, by far more variable, and more difficult to measure than fertility. Unfortunately, too, it affects all age groupings to some extend, though it tends to be greatest in volume in late adolescence and young adulthood. Because the inherent uncertainties are so great, selection of migration assumptions is always more or less arbitrary. Moreover, the New England states differ considerably in their migration patterns. In these circumstances, two general assumptions regarding migration were made, which, as applied to the six states individually, sometimes had to be differentially implemented, as explained below.

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[9] Since economic factors such as employment opportunities, consumer income and the like are related to attitudes toward marriage and parenthood, it is fortunate that the only age categories affected by the fertility assumption are those under ten years in 1960 and those under twenty in 1970. Indeed, since registered births from 4/1/50 to 4/1/55 are the basis for projections to age 5-9 in 1960 and 15-19 in 1970, the fertility assumption directly affects only the fourteen year olds among those of labor force age, even in 1970.

The general assumptions are: first, that the proportionate distribution of net migration components by age and sex experienced from 1940-1950 (the latest decade for which actual population enumerations by age and sex are available), will prevail from 1950 to 1960 and from 1960 to 1970; second, total net migration per projection decade will be in approximate proportion to the total net migration experienced by each state from 1940-1955, as estimated by the Census Bureau[10] adjusted as necessary in the light of current population estimates for each state.[11]

As applied to the New England states, per decade total net migration factors developed according to the above assumptions required no further adjustment for New Hampshire, Massachusetts and Connecticut, and were utilized directly in the projections. For Maine and Vermont, there were consistent indications in the Census Bureau's current estimates that out-migration during the first seven years of the 1950-1960 decade had considerably exceeded the projected migration levels. Accordingly the total net out-migration for these states, 1950-1960, was adjusted upwards to bring the present projections into line with Census current estimates. For both Maine and Vermont, the total net migration projected for 1960-1970 is consistent with the two basic migration assumptions. For Rhode Island, peculiar difficulties arise in connection with the effort to arrive at reasonable estimates of ten-year net migration from 1940-1950, and continue to confuse current population estimates, as well. These difficulties center around the presence of relatively large numbers of military personnel, and around changes in the residential allocations of college students and military personnel in Census definitions.[12] After considering a number of alternatives it was assumed for projection purposes that Rhode Island's total net migration would be -1,379 for 1950-1960, and -4,000 for 1960-1970. The 1950-1960 assumption is proportionate to the Census Bureau's latest current estimate of migration from 1950-1957 (in CPR P-25, No. 186), and the 1960-1970 assumption reduces the out-migration component of Census Projection Series 2 (P-25, No. 160) substantially (from -16,000 to -4,000) to take account of the fact that the most recent Census estimate of Rhode Island's 1955 population (in P-25, No. 165) is appreciably higher (by 10,000), than the 1955 base utilized in the Census projections.[13] Table I-10 shows net migration factors.

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[10] Data were based on Current Population Reports: Population Estimates, Series P-25 No. 160, "Illustrative Projections of the Population by States, 1960, 1965 and 1970", Bureau of the Census, Department of Commerce, Washington, 1957. Specifically, net migration projected components of Census Projection Series 2, 1955-1970, Table 3, p. 14, were multiplied by two-thirds to obtain a preliminary estimated ten-year component for each state. See also page 5 for a statement of the migration assumption of Census Projection Series 2.

[11] cf. CPR, P-25, Nos. 124, 145, 165 and especially 186, which contain estimates of current population, and of components of change from 1950-1954, 1950-1955, 1950-1956, and 1950-1957, respectively.

## C. Population Projections to 1960 and 1970

Applying these methods and assumptions produces the projected populations by age and sex groupings shown in Tables I-1 through I-7 for Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, and New England respectively. It should be noted again that these are working tables, and that detail should be simplified by combining age groupings and rounding numbers to avoid the appearance of spurious accuracy in any published use

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[12] See Kurt B. Mayer and Sidney Goldstein, Migration and Economic Development in Rhode Island, Brown University Press, Providence, 1958, especially pages 15-16.

[13] Arbitrary as these assumptions may appear, they are defensible on logical grounds in the light of current data, as indicated in the text, and they result in a projected total population for Rhode Island which is reasonable when compared to Census Bureau projections of the state's total population. See section on Census Projection Comparisons, below.

Table I-1

## Maine Population Projected to 1960 and 1970 by Age and Sex

| Age in Years | Male | Female | Total |
|---|---|---|---|
| 1950 (Census*) | | | |
| 0-4 | 52,252 | 49,813 | 102,065 |
| 5-9 | 42,223 | 40,143 | 82,366 |
| 10-14 | 36,250 | 35,160 | 71,410 |
| 15-19 | 35,038 | 35,385 | 70,423 |
| 20-24 | 32,683 | 33,976 | 66,659 |
| 25-34 | 63,243 | 64,963 | 128,206 |
| 35-44 | 58,260 | 59,132 | 117,392 |
| 45-54 | 49,989 | 51,352 | 101,341 |
| 55-64 | 40,971 | 41,766 | 82,737 |
| 65 + | 44,458 | 49,104 | 93,562 |
| Total | 455,367 | 460,794 | 916,161 |
| 1960 (Projection) | | | |
| 0-4 | 52,479 | 50,030 | 102,509 |
| 5-9 | 52,286 | 49,679 | 101,965 |
| 10-14 | 50,500 | 47,675 | 98,175 |
| 15-19 | 37,254 | 38,313 | 75,567 |
| 20-24 | 22,393 | 26,254 | 48,647 |
| 25-34 | 48,224 | 56,392 | 104,616 |
| 35-44 | 61,527 | 63,721 | 125,248 |
| 45-54 | 53,222 | 56,164 | 109,386 |
| 55-64 | 41,381 | 44,807 | 86,188 |
| 65 + | 46,126 | 54,467 | 100,593 |
| Total | 465,392 | 487,502 | 952,894 |
| 1970 (Projection) | | | |
| 0-4 | 56,560 | 53,920 | 110,480 |
| 5-9 | 53,798 | 51,179 | 104,977 |
| 10-14 | 51,061 | 48,351 | 99,412 |
| 15-19 | 48,327 | 48,207 | 96,534 |
| 20-24 | 39,611 | 40,740 | 80,351 |
| 25-34 | 44,608 | 54,567 | 99,175 |
| 35-44 | 46,943 | 55,527 | 102,470 |
| 45-54 | 57,743 | 60,925 | 118,668 |
| 55-64 | 45,743 | 49,983 | 95,726 |
| 65 + | 48,770 | 61,023 | 109,793 |
| Total | 493,164 | 524,422 | 1,017,586 |

* 1950 Census corrected for underenumeration of 0-4 year olds.

Table I-2

## New Hampshire Population Projected to 1960 and 1970 by Age and Sex

| Age in Years | Male | Female | Total |
|---|---|---|---|
| | | 1950 (Census*) | |
| 0-4 | 28,326 | 27,498 | 55,824 |
| 5-9 | 22,371 | 21,429 | 43,800 |
| 10-14 | 18,999 | 18,265 | 37,264 |
| 15-19 | 18,775 | 18,689 | 37,464 |
| 20-24 | 18,824 | 19,137 | 37,961 |
| 25-34 | 37,322 | 38,934 | 76,256 |
| 35-44 | 34,989 | 36,762 | 71,751 |
| 45-54 | 31,281 | 32,508 | 63,789 |
| 55-64 | 25,629 | 27,016 | 52,645 |
| 65 + | 26,570 | 31,223 | 57,793 |
| Total | 263,086 | 271,461 | 534,547 |
| | | 1960 (Projection) | |
| 0-4 | 29,612 | 28,745 | 58,357 |
| 5-9 | 28,997 | 28,179 | 57,176 |
| 10-14 | 28,119 | 27,330 | 55,449 |
| 15-19 | 22,112 | 21,851 | 43,963 |
| 20-24 | 17,455 | 17,382 | 34,837 |
| 25-34 | 34,437 | 35,816 | 70,253 |
| 35-44 | 36,824 | 39,832 | 76,656 |
| 45-54 | 33,936 | 36,387 | 70,323 |
| 55-64 | 26,882 | 29,743 | 56,625 |
| 65 + | 30,428 | 38,022 | 68,450 |
| Total | 288,802 | 303,287 | 592,089 |
| | | 1970 (Projection) | |
| 0-4 | 33,251 | 32,279 | 65,530 |
| 5-9 | 31,305 | 30,422 | 61,727 |
| 10-14 | 29,410 | 28,585 | 57,995 |
| 15-19 | 28,698 | 28,577 | 57,275 |
| 20-24 | 26,492 | 26,398 | 52,890 |
| 25-34 | 36,396 | 37,233 | 73,629 |
| 35-44 | 34,049 | 36,792 | 70,841 |
| 45-54 | 35,758 | 39,413 | 75,171 |
| 55-64 | 29,351 | 33,473 | 62,824 |
| 65 + | 33,068 | 43,648 | 76,716 |
| Total | 317,778 | 336,820 | 654,598 |

* 1950 Census corrected for underenumeration of 0-4 year olds.

## Table I-3

## Vermont Population Projected to 1960 and 1970 by Age and Sex

| Age in Years | Male | Female | Total |
|---|---|---|---|
| | | 1950 (Census*) | |
| 0-4 | 22,016 | 20,929 | 42,945 |
| 5-9 | 17,737 | 16,697 | 34,434 |
| 10-14 | 15,127 | 14,387 | 29,514 |
| 15-19 | 14,122 | 14,572 | 28,694 |
| 20-24 | 13,582 | 13,902 | 27,484 |
| 25-34 | 25,763 | 26,505 | 52,268 |
| 35-44 | 24,313 | 24,048 | 48,361 |
| 45-54 | 20,614 | 20,664 | 41,278 |
| 55-64 | 16,820 | 17,419 | 34,239 |
| 65 + | 18,175 | 21,359 | 39,534 |
| Total | 188,269 | 190,482 | 378,751 |
| | | 1960 (Projection) | |
| 0-4 | 22,279 | 21,178 | 43,457 |
| 5-9 | 21,966 | 20,688 | 42,654 |
| 10-14 | 20,222 | 18,725 | 38,947 |
| 15-19 | 15,084 | 16,256 | 31,340 |
| 20-24 | 8,915 | 10,289 | 19,204 |
| 25-34 | 15,611 | 22,090 | 37,701 |
| 35-44 | 22,195 | 25,387 | 47,582 |
| 45-54 | 20,981 | 21,649 | 42,630 |
| 55-64 | 14,264 | 16,934 | 31,198 |
| 65 + | 18,463 | 23,090 | 41,553 |
| Total | 179,980 | 196,286 | 376,266 |
| | | 1970 (Projection) | |
| 0-4 | 24,452 | 23,245 | 47,697 |
| 5-9 | 22,892 | 21,665 | 44,557 |
| 10-14 | 21,250 | 19,945 | 41,195 |
| 15-19 | 20,444 | 20,404 | 40,848 |
| 20-24 | 16,711 | 16,457 | 33,168 |
| 25-34 | 17,339 | 23,018 | 40,357 |
| 35-44 | 13,660 | 21,365 | 35,025 |
| 45-54 | 19,915 | 23,689 | 43,604 |
| 55-64 | 16,284 | 18,881 | 35,165 |
| 65 + | 17,764 | 24,812 | 42,576 |
| Total | 190,711 | 213,481 | 404,192 |

* 1950 Census corrected for underenumeration of 0-4 year olds.

## Table I-4

## Massachusetts Population Projected to 1960 and 1970 by Age and Sex

| Age in Years | Male | Female | Total |
|---|---|---|---|
| | | 1950 (Census*) | |
| 0-4 | 234,774 | 224,788 | 459,562 |
| 5-9 | 186,744 | 178,009 | 364,753 |
| 10-14 | 150,672 | 144,835 | 295,507 |
| 15-19 | 151,474 | 157,032 | 308,506 |
| 20-24 | 171,871 | 179,741 | 351,612 |
| 25-34 | 356,410 | 375,303 | 731,713 |
| 35-44 | 316,047 | 344,060 | 660,107 |
| 45-54 | 275,962 | 302,724 | 578,686 |
| 55-64 | 230,863 | 251,515 | 482,378 |
| 65 + | 201,040 | 267,396 | 468,436 |
| Total | 2,275,857 | 2,425,403 | 4,701,260 |
| | | 1960 (Projection) | |
| 0-4 | 252,523 | 241,787 | 494,310 |
| 5-9 | 252,406 | 241,753 | 494,159 |
| 10-14 | 234,064 | 224,193 | 458,257 |
| 15-19 | 182,634 | 182,846 | 365,480 |
| 20-24 | 141,768 | 148,620 | 290,388 |
| 25-34 | 300,542 | 326,144 | 626,686 |
| 35-44 | 350,027 | 371,893 | 721,920 |
| 45-54 | 296,025 | 327,994 | 624,019 |
| 55-64 | 230,667 | 267,807 | 498,474 |
| 65 + | 242,044 | 330,801 | 572,845 |
| Total | 2,482,700 | 2,663,838 | 5,146,538 |
| | | 1970 (Projection) | |
| 0-4 | 274,453 | 262,785 | 537,238 |
| 5-9 | 262,945 | 251,855 | 514,800 |
| 10-14 | 251,824 | 241,233 | 493,057 |
| 15-19 | 247,972 | 246,421 | 494,393 |
| 20-24 | 224,537 | 227,682 | 452,219 |
| 25-34 | 301,766 | 321,105 | 622,871 |
| 35-44 | 295,687 | 323,702 | 619,389 |
| 45-54 | 328,808 | 355,441 | 684,249 |
| 55-64 | 249,567 | 292,463 | 542,030 |
| 65 + | 259,906 | 374,611 | 634,517 |
| Total | 2,697,465 | 2,897,298 | 5,594,763 |

* 1950 Census corrected for underenumeration of 0-4 year olds.

## Table I-5

## Rhode Island Population Projected to 1960 and 1970 by Age and Sex

| Age in Years | Male | Female | Total |
|---|---|---|---|
| | | 1950 (Census*) | |
| 0-4 | 40,332 | 38,319 | 78,651 |
| 5-9 | 30,435 | 29,973 | 60,408 |
| 10-14 | 24,815 | 24,006 | 48,821 |
| 15-19 | 28,462 | 25,473 | 53,935 |
| 20-24 | 35,431 | 31,324 | 66,755 |
| 25-34 | 64,932 | 65,760 | 130,692 |
| 35-44 | 54,014 | 58,200 | 112,214 |
| 45-54 | 45,423 | 49,537 | 94,960 |
| 55-64 | 36,970 | 39,911 | 76,881 |
| 65 + | 30,712 | 39,706 | 70,418 |
| Total | 391,526 | 402,209 | 793,735 |
| | | 1960 (Projection) | |
| 0-4 | 41,669 | 39,588 | 81,257 |
| 5-9 | 41,671 | 39,661 | 81,332 |
| 10-14 | 40,101 | 38,200 | 78,301 |
| 15-19 | 30,837 | 30,062 | 60,899 |
| 20-24 | 25,675 | 24,211 | 49,886 |
| 25-34 | 63,222 | 56,701 | 119,923 |
| 35-44 | 63,771 | 64,805 | 128,576 |
| 45-54 | 49,696 | 54,511 | 104,207 |
| 55-64 | 38,148 | 42,738 | 80,886 |
| 65 + | 36,587 | 49,094 | 85,681 |
| Total | 431,377 | 439,571 | 870,948 |
| | | 1970 (Projection) | |
| 0-4 | 44,496 | 42,274 | 86,770 |
| 5-9 | 42,942 | 40,866 | 83,808 |
| 10-14 | 41,441 | 39,467 | 80,908 |
| 15-19 | 41,666 | 39,611 | 81,277 |
| 20-24 | 40,212 | 38,171 | 78,383 |
| 25-34 | 55,926 | 54,046 | 109,972 |
| 35-44 | 61,998 | 55,878 | 117,876 |
| 45-54 | 58,953 | 60,880 | 119,833 |
| 55-64 | 42,075 | 47,368 | 89,443 |
| 65 + | 39,738 | 55,354 | 95,092 |
| Total | 469,447 | 473,915 | 943,362 |

---

* 1950 Census corrected for underenumeration of 0-4 year olds.

## Table I-6

## Connecticut Population Projected to 1960 and 1970 by Age and Sex

| Age in Years | Male | Female | Total |
|---|---|---|---|
| | | 1950 (Census*) | |
| 0-4 | 102,228 | 97,010 | 199,238 |
| 5-9 | 82,229 | 78,451 | 160,680 |
| 10-14 | 62,292 | 59,314 | 121,606 |
| 15-19 | 60,848 | 60,810 | 121,658 |
| 20-24 | 70,189 | 74,169 | 144,358 |
| 25-34 | 164,453 | 175,830 | 340,283 |
| 35-44 | 148,678 | 153,520 | 302,198 |
| 45-54 | 119,408 | 123,813 | 243,221 |
| 55-64 | 100,175 | 101,697 | 201,872 |
| 65 + | 80,387 | 96,437 | 176,824 |
| Total | 990,887 | 1,021,051 | 2,011,938 |
| | | 1960 (Projection) | |
| 0-4 | 119,464 | 113,368 | 232,832 |
| 5-9 | 117,235 | 111,054 | 228,289 |
| 10-14 | 106,155 | 100,331 | 206,486 |
| 15-19 | 84,070 | 82,464 | 166,534 |
| 20-24 | 62,271 | 65,809 | 128,080 |
| 25-34 | 142,364 | 154,919 | 297,283 |
| 35-44 | 174,821 | 186,595 | 361,416 |
| 45-54 | 147,327 | 152,903 | 300,230 |
| 55-64 | 105,281 | 114,852 | 220,133 |
| 65 + | 108,203 | 133,545 | 241,748 |
| Total | 1,167,191 | 1,215,840 | 2,383,031 |
| | | 1970 (Projection) | |
| 0-4 | 135,603 | 128,683 | 264,286 |
| 5-9 | 129,622 | 122,823 | 252,445 |
| 10-14 | 123,353 | 116,674 | 240,027 |
| 15-19 | 118,914 | 114,976 | 233,890 |
| 20-24 | 106,187 | 106,674 | 212,861 |
| 25-34 | 157,563 | 168,220 | 325,783 |
| 35-44 | 153,335 | 166,082 | 319,417 |
| 45-54 | 172,358 | 185,090 | 357,448 |
| 55-64 | 130,209 | 142,237 | 272,446 |
| 65 + | 124,007 | 162,914 | 286,921 |
| Total | 1,351,151 | 1,414,373 | 2,765,524 |

---

* 1950 Census corrected for underenumeration of 0-4 year olds.

Table 1-7

## Total New England Population Projected to 1960 and 1970 by Age and Sex

| Age in Years | Male | Female | Total |
|---|---|---|---|
| | | 1950 (Census*) | |
| 0-4 | 479,928 | 458,357 | 938,285 |
| 5-9 | 381,739 | 364,702 | 746,441 |
| 10-14 | 308,155 | 295,967 | 604,122 |
| 15-19 | 308,719 | 311,961 | 620,680 |
| 20-24 | 342,580 | 352,249 | 694,829 |
| 25-34 | 712,123 | 747,295 | 1,459,418 |
| 35-44 | 636,301 | 675,722 | 1,312,023 |
| 45-54 | 542,677 | 580,598 | 1,123,275 |
| 55-64 | 451,428 | 479,324 | 930,752 |
| 65 + | 401,342 | 505,225 | 906,567 |
| Total | 4,564,992 | 4,771,400 | 9,336,392 |
| | | 1960 (Projection) | |
| 0-4 | 518,026 | 494,696 | 1,012,722 |
| 5-9 | 514,561 | 491,014 | 1,005,575 |
| 10-14 | 479,161 | 456,454 | 935,615 |
| 15-19 | 371,991 | 371,792 | 743,783 |
| 20-24 | 278,477 | 292,565 | 571,042 |
| 25-34 | 604,400 | 652,062 | 1,256,462 |
| 35-44 | 709,165 | 752,233 | 1,461,398 |
| 45-54 | 601,187 | 649,608 | 1,250,795 |
| 55-64 | 456,623 | 516,881 | 973,504 |
| 65 + | 481,851 | 629,019 | 1,110,870 |
| Total | 5,015,442 | 5,306,324 | 10,321,766 |
| | | 1970 (Projection) | |
| 0-4 | 568,815 | 543,186 | 1,112,001 |
| 5-9 | 543,504 | 518,810 | 1,062,314 |
| 10-14 | 518,339 | 494,255 | 1,012,594 |
| 15-19 | 506,021 | 498,196 | 1,004,217 |
| 20-24 | 453,750 | 456,122 | 909,872 |
| 25-34 | 613,598 | 658,189 | 1,271,787 |
| 35-44 | 605,672 | 659,346 | 1,265,018 |
| 45-54 | 673,535 | 725,438 | 1,398,973 |
| 55-64 | 513,229 | 584,405 | 1,097,634 |
| 65 + | 523,253 | 722,362 | 1,245,615 |
| Total | 5,519,716 | 5,860,309 | 11,380,025 |

* 1950 Census corrected for underenumeration of 0-4 year olds.

of the figures. It should also be noted that the tabulations for 1950 do not agree with published Census figures for the 0-4 age grouping or for total state populations, because of the correction of the Census for under-enumeration of 0-4 year olds. Finally, it must be observed that while these projections are regarded by the writer as based on the most reasonable assumptions that can be made at this time they nevertheless represent mid-point estimates of probable future populations which might easily vary by two or three percent from actual future experience even without radical departure from the assumptions.[14/]

Comparing the projections for the six states shows great divergencies in patterns of projected change. All six states show some increase in population from 1950 to 1970, but the projected gain for Vermont with its large out-migration is only 6.7 percent for the twenty years; while that for Connecticut, for which a large in-migration is assumed, is 37.5 percent. Maine, like Vermont, has a large out-migration and a small projected rate of increase of 11.1 percent for the 20 years. New Hampshire, with a small in-migration, and Massachusetts and Rhode Island with small out-migrations, show projected twenty-year rates of increase of 22.5, 19.0 and 18.9 percent respectively. These differences reemphasize the importance of the migration assumptions in state population projections.

Migration differentials also importantly affect changing age distributions, especially for Connecticut, Maine and Vermont where the migration components are relatively large, although age shifts from decade to decade are perhaps most profoundly influenced by the simple phenomenon of aging, which in a decade, moves each age category into a new tabular position, ten

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[14/] The suggested range of error applies to state totals. For specific age groupings the range of error could be much greater, especially for the smaller states.

years older. Finally, changes in sex ratios are influenced by differential migration; but are also affected, especially toward the older ages, by the fact that while more male babies are born, male death rates at every age are somewhat higher than female death rates. Since present mortality (survival) assumptions continue past trends toward a greater female longevity, the projections tend to show a decreasing proportion of males at the older ages. In this respect, however, the six states tend to be similar to each other, and to projected national trends, with only minor exceptions.

### D. Census Projection Comparisons

Of the four series of projections for states developed by the Census Bureau in 1957, Series 2 most closely parallels in its assumptions those adopted here.[15/] In November of 1958, however, a new set of United States projections was published, which adjusts former Census Bureau estimates upward, through modification of both fertility and mortality assumptions.[16/] No state projections are included, but a method of adjusting the totals of the earlier state projections to the levels of the new national projections is suggested.[17/] Table I-8 summarizes Census Series 2 projection totals for the New England states as originally developed and as revised upward to the levels of the new national projections; and compares them with the total figures arrived at in the present, Boston University 1958 series. Current estimates for 1957 are included in the table because this is the base year for the new Census projections.[18/]

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[15/] CPR P-25, No. 160, dated August 9, 1957. See page 5 for statement of Series 2 assumptions.

[16/] Meyer Zitter and Jacob S. Siegel, op. cit.

[17/] Ibid., p. 14. Actually two methods are suggested. The one utilized in the present report is more the refined one of the two, based on projected distributions of births by states as developed in the P-25, No. 160 CPR.

[18/] 1957 figures from CPR, P-25, No. 186.

## Table I-8

### Projections of Population: New England States
### Census Series 2 Compared to Boston University 1958 Series

| State and Projection | Year | | | |
|---|---|---|---|---|
| | 1950* | 1957 | 1960 | 1970 |
| **Maine** | | | | |
| Census 2 revised | | 939,000 | | 1,042,000 |
| BU 1958 | 916,161 | | 953,000 | 1,018,000 |
| Census 2 original | | | 932,000 | 994,000 |
| **New Hampshire** | | | | |
| Census 2 revised | | 573,000 | | 669,000 |
| BU 1958 | 534,547 | | 592,000 | 655,000 |
| Census 2 original | | | 580,000 | 642,000 |
| **Vermont** | | | | |
| Census 2 revised | | 370,000 | | 413,000 |
| BU 1958 | 378,751 | | 376,000 | 404,000 |
| Census 2 original | | | 376,000 | 394,000 |
| **Massachusetts** | | | | |
| Census 2 revised | | 4,827,000 | | 5,750,000 |
| BU 1958 | 4,701,260 | | 5,147,000 | 5,595,000 |
| Census 2 original | | | 5,004,000 | 5,514,000 |
| **Rhode Island** | | | | |
| Census 2 revised | | 857,000 | | 957,000 |
| BU 1958 | 793,735 | | 871,000 | 943,000 |
| Census 2 original | | | 850,000 | 918,000 |
| **Connecticut** | | | | |
| Census 2 revised | | 2,269,000 | | 2,917,000 |
| BU 1958 | 2,011,938 | | 2,383,000 | 2,766,000 |
| Census 2 original | | | 2,391,000 | 2,802,000 |

* Adjusted for underenumeration of 0-4 year olds.

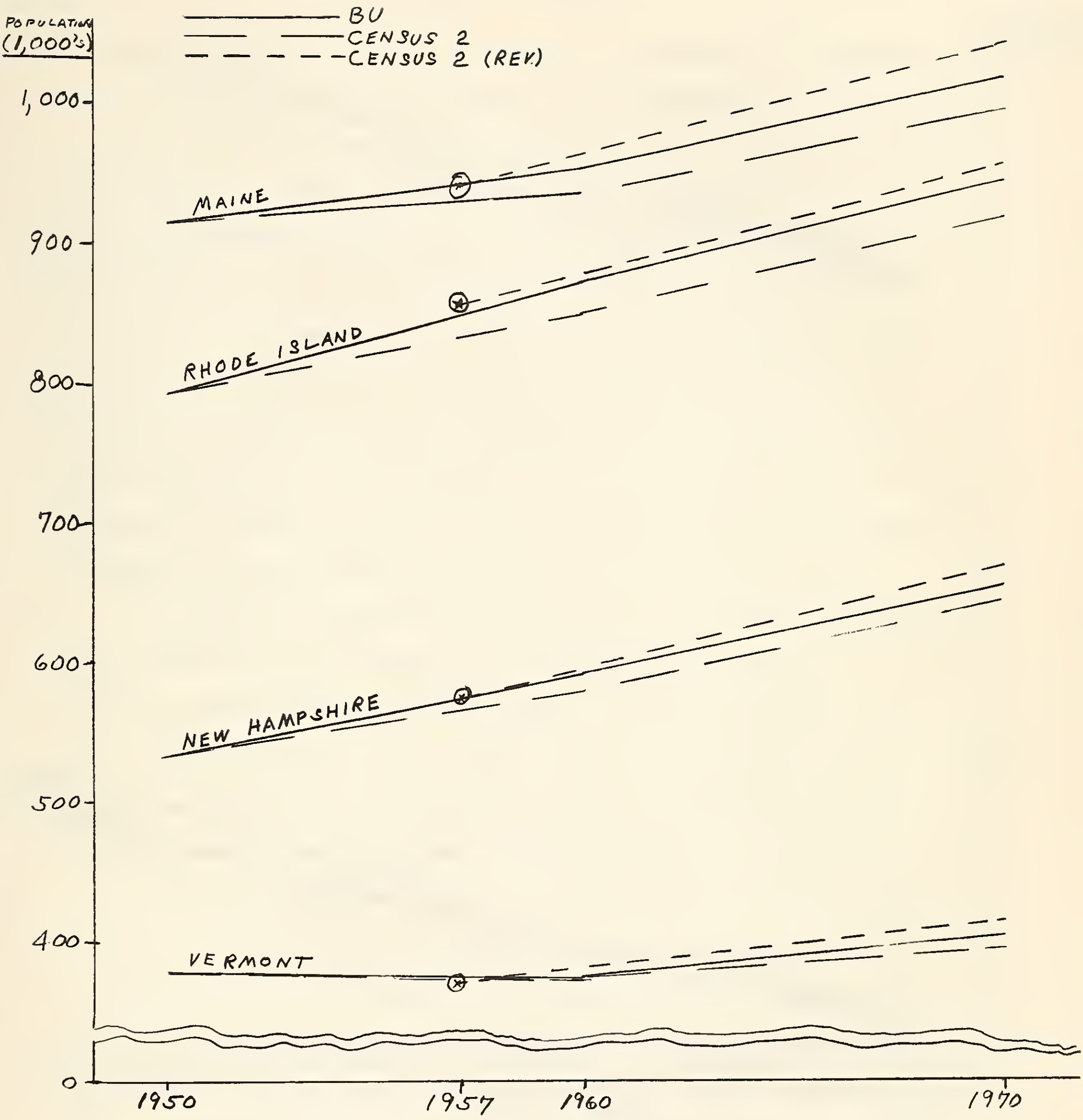

FIGURE I-1 PROJECTION COMPARISONS

FLS 1/30/59

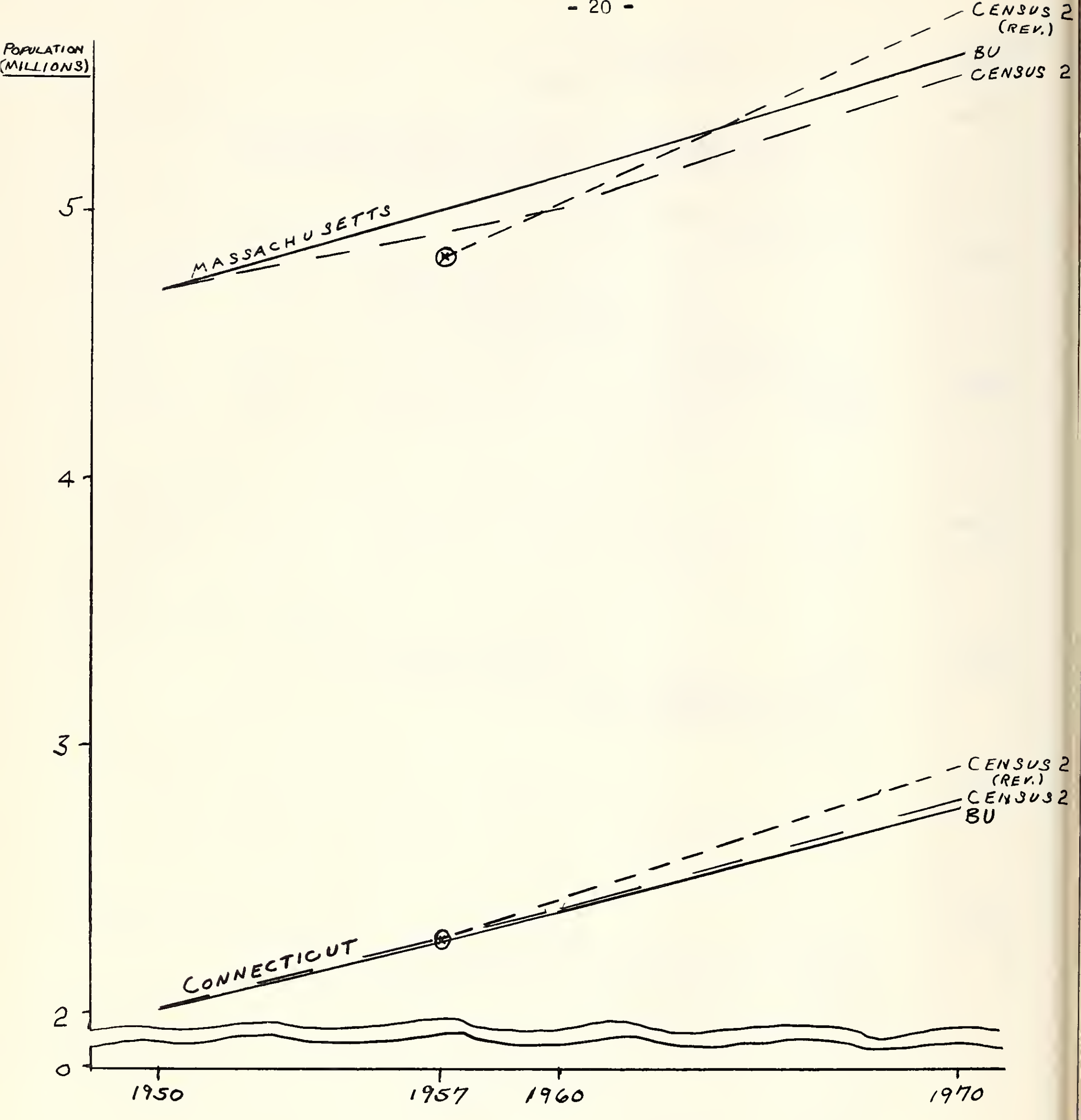

FIGURE I-2 PROJECTION COMPARISONS

FLS 1/30/59

The data of Table I-8 are plotted in Figure I-1 for Maine, New Hampshire, Vermont and Rhode Island; and in Figure I-2 for Massachusetts and Connecticut. Examination of the figures and the table shows that: (1) For 1970, the BU 1958 series falls between the original and the revised Census Series 2 for all the New England States, except Connecticut, usually fairly close to the midpoint between the two Census figures; (2) For Maine, New Hampshire and Connecticut, the latest Census current estimate (1957) falls almost exactly on the BU 1958 series trend line, and for Vermont and Rhode Island, it is close to the trend line—only in Massachusetts is there considerable divergence (at the scale of the charts) between the BU series trend line and the Census 1957 estimate; (3) only in Rhode Island is the 1957 Census estimate clearly above the BU series trend line (at the scale of the charts).

On the whole, it would appear that this is a reasonably close correspondence between the BU 1958 series, and the Census Series 2 projections, although for three states--Connecticut, Massachusetts and Rhode Island there are residual problems which perhaps need further study. The fact that both the original and revised Census Series 2 projections exceed the BU 1958 series for 1970 probably results from differences in technique between the Census and the BU projections or from special features in Connecticut's age-sex distribution, or both. For Massachusetts, the problem centers in some doubt as to the current population, and migration experience since 1950. The 1955 Massachusetts Census enumerated fewer people than had been independently estimated by the Census Bureau for 1/1/55.[19/] Nevertheless, the Massachusetts Census results were incorporated into the Census series. It should also be noted that the Census current estimates of out-migration for Massachusetts vary greatly from

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19/ Verbal statement to the writer by Jacob S. Siegle, Director of the Population Estimates and Projections Section, Census Bureau.

year to year;[20] further study of current estimates, and recent migration for Massachusetts might lead to greater confidence in the projections. For Rhode Island, similarly, special study of current population estimates and recent migration, especially in relation to military versus civilian personnel, could provide a better basis for evaluation of projections of the state's population.

## E. Procedural Detail

The computation of population by the methods outlined above, while simple in logical principle, is intricate in practice. In describing the detailed procedures by which the Boston University 1958 projections were developed, therefore, an effort will be made to combine concise statement with clarity, by utilizing selected portions of the computations for Vermont to illustrate the procedures, adding comments or footnotes to elucidate special problems, or differentiating factors involved in the computations for the other states.

### Basic Computations

Table I-9 reproduces a portion of the basic computation table for Vermont males in the first two age categories of 1950, 0-4 and 5-9, and shows the steps by which these data were projected successively to ages 10-14 and 15-19 in 1960; and to 20-24 and 25-29 in 1970.[21]

The text following describes succinctly the derivation of the figures in each column of Table I-9.

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[20] As reported in CPR, P-25, Nos. 124, 145, 164, and 186.

[21] Special procedures for projecting ages 0-4 and 5-9 in 1960 and 1970 are described in a separate subsection, "Projecting Ages Under 10 Years."

## Table I-9

## Projection Computation Table, Vermont Males

| Age | Census Pop., 1950 | '49-'51 Survival Rate | Estimated Survival 1960 | Migration Component '59-'60 | Projected Population 1960 | Estimated '59-'61 Survival Rate | Estimated Survival 1970 | Migration Component '60-'70 | Projected Population 1970 |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0-4 | 22,016 | .9928 | | | | | | | |
| 5-9 | 17,737 | .9918 | | | | | | | |
| 0-14 | | | 21,857 | -1,635 | 20,222 | .9864 | | | |
| 5-19 | | | 17,592 | -2,508 | 15,084 | .9831 | | | |
| 0-24 | | | | | | | 19,947 | -3,236 | 16,711 |
| 5-29 | | | | | | | 14,829 | -3,786 | 11,043 |

Column (1), (1950 Population). The number of Vermont males 0-4 on the Census date 4/1/50 was obtained by correcting the published Census figure, 21,501, for underenumeration. The correction factor, 1.023942, used as a multiplier is based on a post-enumeration survey conducted by the Census Bureau for the express purpose of determining the accuracy of the 1950 Census. Since the factor is derived from national figures for both sexes, it is used for males and females in all six New England states.[22/] The

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[22/] Infant Enumeration Study (Procedural Studies of the 1950 Census, No. 1), Bureau of the Census, Washington, 1953, p. 3, describes the basic data.

number of males 5-9, (and in all other age-sex groupings) is the published Census figure for Vermont.

Column (2), (1949-1951 Ten-Year Survival Rates). The survival rates were computed directly from life tables for the white population of Vermont, 1949-1951, published by the National Office of Vital Statistics.[23/] For all 5-year age groupings up to 70-74 years, the rate is the number in the middle year of the five-year grouping ten years older, divided by the number in the middle year of the grouping under consideration, as listed in column $L_x$ of the life table, "Stationary Population: In year of age." For the age grouping 75 and over, used in the computations, it is the number shown in the 85th year divided by the number in the 75th year in column $T_x$ of the life table, "Stationary Population: In this year of age and all subsequent years."

Column (3), (Estimated Survivors, 1960). The estimated number of survivors, age 10-14 in 1960, is the number 0-4 in 1950, multiplied by the 1949-1951 ten-year survival rate for males 0-4. Similarly, 1960 survivors in each age category above age 10 are estimated by multiplying the 1950 Census figure by the survival rate for that age grouping.

Column (4) and Column (8), (Migration Components). The computation of the migration components for Vermont 1950-1960 and 1960-1970, required several steps:

(a) 1940-1950 migration components for five-year age-sex groupings were calculated. This required that the 1940 Census be corrected for underenumeration in age 0-4, using factors for 1940,[24/]

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[23/] National Office of Vital Statistics, Vital Statistics - Special Reports - Life Tables For 1949-1951, v. 41, Supplements containing State Life Tables for the New England States.

[24/] The factors are: 1.04998 for males; 1.05108 for females. See A. J. Jaffe, Handbook of Statistical Methods for Demographers. Preliminary Edition, GPO Washington, 1951, Table 21, p. 146, factors for Northeastern U. S.

and for the change in Census residential allocation of college students in 1950 as compared to 1940.[25/] Correction for residential allocation of college students was accomplished by subtracting from age groups 15-19 and 20-24 the number of residents shown by the 1940 Census as attending college and adding back the numbers shown as attending institutions of higher learning within the state by statistics on college attendance published by the United States Office of Education.[26/] Survivors from 1940 to 1950 were then estimated by applying appropriate survival rates[27/] to each age-sex category of the 1940 Census. The difference between the estimated number of survivors in a given 5-year age-sex group and the 1950 Census enumeration for that age-sex group (plus or minus), is the estimated migration component for that age-sex grouping. Similarly, migration components were estimated for each age-sex grouping over 10 years in 1950. Because estimated migration components for age groups from birth to 0-4 and 5-9 in 1950 were needed for further manipulations, these were estimated in turn by utilizing average relationships between migration rates for 10-14 year olds (in 1950) and migration rates from birth to ages 5-9 and 0-4, using a technique suggested to the writer by Meyer Zitter and Jacob S. Siegel

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[25/] In 1940, the Census Bureau counted college students as residents of their parent's home communities; in 1950, they were counted as residents of the communities in which they lived while attending school.

[26/] Statistical Abstract of the United States, 1941, Washington, 1941, Table on "Institutions of Higher Education - 1940 Fall Enrollment...By Sex... By States."

[27/] Survival rates used were means of the 1949-1951 rates described above, and similarly calculated 1939-1941 rates, based on National Office of Vital Statistics, State and Regional Life Tables, 1939-1941, Washington, 1948.

of the Census Bureau.[28] Summing algebraically the migration components for each age-sex grouping produced a calculated total net migration for Vermont, 1940-50, of -21,577.

(b) The ten-year total net migration for use in projecting Vermont's population from 1960 to 1970, was taken as -26,667, two-thirds of the migration component for Vermont in Census Projection, Series 2, for the fifteen years from 1955-1970 (*CPR*, P-25 No. 160).[29] Adjustment of the age-sex specific migration components to add to the desired total net migration was accomplished by computing a "plus factor" and a "minus factor" by which the plus and minus age-specific components were multiplied.

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[28] The 10-14 migration rate is the estimated number of migrants aged 10-14 in 1950, divided by the number enumerated (and corrected for under-enumeration) age 0-4 in 1940. For Vermont males, this rate was -.045628. Three-fourths of this rate, -.034221, times the number of male infants born in Vermont from 4/1/40 to 4/1/45 (18,506) produces the estimated migration component for males 5-9 in 1950, which is -633. For the 0-4 component, the 10-14 migration rate is multiplied by 1.5 and then by 1/4 (since on the average those under 5 in 1950 lived only $2\frac{1}{2}$ years from birth to 1950 - $\frac{1}{4}$ of the ten-year 1940-1950 migration period we are concerned with). The number of male infants born in Vermont from 4/1/45 to 4/1/50 (the Census date) was 22,955, and the adjusted migration rate was -.017110, giving a product of -393 as the estimated migration component, males age 0-4, 1950. Birth figures were derived by summing total registered births for the state from National Office of Vital Statistics Publications, *Vital Statistics of the United States* for the years 1940 to 1950 inclusive; adjusting proportionately to the April 1st quinquennial dates in 1940, 1945 and 1950; correcting for underregistration of births using factors estimated for each state by linear interpolation to midpoint dates for each period between published factors for 1940 and 1950. (*Vital Statistics--Special Reports--Selected Studies*, v. 45, No. 9, Oct. 13, 1956, tables 1 and 2); and distributing by sex on the assumption that 51.456 percent of live births were male.

[29] See also discussion of migration, this report, section on "Assumptions" above.

The formulae are:

$$\text{"plus factor"} = \frac{S/n/ -/- (T-Sn)}{S/n/}$$

$$\text{"minus factor"} = \frac{S/n/ - (T-Sn)}{S/n/}$$

when $S/n/$ = the sum of the age-specific migration components without regard to sign,

$T$ = the desired total net migration

$Sn$ = the algebraic sum of the age-specific migration components.[30]

Age-specific migration components in Table I-9 were computed by applying this technique to the 1940-1950 migration components for Vermont, taking T as equal to -26,667 for the 1960-1970 migration components, and T as equal to -52,377 for the 1950-1960 components.

(c) The total net migration of -52,377 used in projecting from 1950 to 1960 represents an adjustment made to take account of the rather large volume of out-migration shown for Vermont in Census current estimates of the state's population.

Specifically, a trial projection was made to 1960 using -26,667 as the total net migration and the projected total population for July 1, 1957 was computed by linear interpolation between 1950 and 1960. The interpolated total population was 395,710, which is 25,710 larger than the Census Bureau's current estimate of 370,000 for 7/1/57 (CPR, P-25, #186). Taking -25,710 as the measure of excess out-migration beyond that allowed in the trial projection (-26,667) and summing algebraically gives the total of -52,377, the total net migration allowance used in the projection of Vermont's population from 1950 to 1960.[31/]

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[30] Technique suggested to the writer by Dr. Jacob S. Siegel, Chief, Estimates and Projections Section, Population Division, Bureau of the Census.

Entries in Table I-9, columns (4) and (8) for Vermont males are the appropriate age-specific migration components developed as described above.[32/]

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[31/] Making so large an adjustment strains the logic of the procedure to some extent, since the "plus factor" changes its sign. In the Vermont example, however, there were no in-migration age-specific components except for age groups 65 and over, which are combined in Labor Force calculations, so that it is reasonable to shift these positive components to small out-migrations for the aged as a group. The difficulty lies, not in the mathematics, but in the fact that when the "plus factor" acquires a negative sign, small in-migration components become small out-migration components on adjustment, but large in-migration components become large out-migration components! Since, in effect, only one age group is involved for Vermont (65 and over) this illogical resultant of the adjustment from positive to negative components is of no consequence. In one other state, Maine, the required adjustment also produced a "plus factor" with a negative sign for the 1950-1960 decade. Again, age-specific components for age groupings 65 and over were positive as computed for 1940-1950: but in addition, positive components appeared for males age 40-44 and 50-54; and for females age 35-39, 40-44, and 50-54. Fortunately, the numbers were so small, as adjusted (ranging from -4 to -82), that no correction was necessary.

[32/] Migration components for the other five New England states were similarly computed.
For Maine, migration components were adjusted in the same way as for Vermont, for the same reasons. Maine's total net migration was assumed to be -73,485 for 1950-1960, and -53,872 for 1960-1970. (The latter figure is twice the computed 1940-1950 total net migration (-26,936), approximating the CPR, P-25, No. 160 Census projection Series 2 ten-year equivalent migration component for Maine of -51,333.)
For New Hampshire, 1940-1950 total net migration was calculated as -2,621, which was adjusted to +3,333 on the basis of Census Projection Series 2, as previously explained. The projected trend line corresponded closely to current Census estimates for the state, so this first adjustment was used as the migration assumption for both decades of the projection.
For Massachusetts, the calculated 1940-1950 total net migration was +19,215; this was adjusted to the Census Series 2 basis of -12,000 for both projection decades.
For Rhode Island, total net migration constituted a special problem, and required special assumptions, as explained in the text of this report, in the section on "Assumptions."
For Connecticut, the computed 1940-1950 total net migration figure of +128,404 was so close to the Census Series 2 ten-year equivalent migration component of 130,667, that it was used directly for both projection decades.

Net migration factors used in projecting population of the New England states to 1970 follow in Table I-10.

Table I-10

## Net Migration Factors Used in Projecting Population of the New England States to 1970

Net Migration by Decade, 1940 - 1970

| | 1940-50 | 1950-60 | 1960-70 |
|---|---|---|---|
| New England | +111,285 | -7,504 | +35,198 |
| Maine | -26,936 | -73,485 | -53,872 |
| New Hampshire | -2,621 | +3,333 | +3,333 |
| Vermont | -21,577 | -52,377 | -26,667 |
| Massachusetts | +19,215 | -12,000 | -12,000 |
| Rhode Island | +14,800 | -1,379 | -4,000 |
| Connecticut | +128,404 | +128,404 | +128,404 |

Column (5), (Projected Population, 1960). The 1960 figures are algebraic sums of the estimated survivors from 1950 (column 3) and the age-specific migration components (column 4).

Column (6), (Estimated 1959-1961 Survival Rates). These ten-year survival rates for five-year age-sex groupings were estimated by application of the rate of change in five-year survival rates projected by the Federal Security Administration from 1955-1960 to 1965-1970.[33] The FSA projects two series of survival rates for the United States, one assuming relatively low mortality, and one assuming relatively high mortality. Following the precedent set by the Bureau of the Census in estimating the mortality (survival) component for projection purposes (In CPR, P-25, No. 160 Series 1, and in P-25, No. 187, all series), the mean percent change of the "high" and "low" projected rates was used to adjust our 1949-1951 ten-year survival rates to an estimated 1959-1961 level of survival. To illustrate, the FSA "high" mortality survival rate for age grouping 10-14 (male) increased by .0191% from 1955-1960 to 1965-1970, while the FSA "low" mortality survival rate increased by .0683%, the mean being .0437%. Applying this percent to the 1949-1951 rate (.9860) gives the rate .9864 for this age-sex grouping shown in Table I-9. Estimated survival rates for other age-sex groupings, and for the other New England states were calculated in the same manner.

Columns (7) - (9). The computations of Table I-9 leading to the 1970 projections of Vermont males, 20-24 and 25-29, follow the procedures already described in projecting from 1950 to 1960, starting with the 1960 projection as the base population.

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[33] T. N. E. Greville, Illustrative United States Population Projections, Division of the Actuary, Social Security Administration, Actuarial Study No. 46, Washington, May, 1957.

## Projecting Ages Under 10 Years.

(1) Ages 5-9. The numbers age 5-9 were projected for both 1960 and 1970 (all states) by (a) estimating the numbers 0-4 in 1955 or 1965, (b) calculating survivors (now 5-9) in 1960 or 1970 by applying five-year survival rates (1949-1951 or estimated 1959-1961) derived as were the ten-year survival rates used in the main body of the projection, and (c) adding algebraically to the survivors an estimated five-year migration component (taken as ½ the ten-year migration component for the 5-9 age category).

Since steps (b) and (c) will be clear to those who have followed the argument in the previous subsection in detail, only (a) need be discussed further. For 1955, the estimate of the total number (male and female) 0-4 was arrived at by summing the numbers of births for each state from 4/1/50 to 4/1/55 from National Office of Vital Statistics sources; correcting for underregistration using 1950 factors;[34/] and multiplying by the ratio of 1950 Census population, 0-4 (corrected for underenumeration) to numbers of births registered ( and corrected for underregistration) from 4/1/45 to 4/1/50. This procedure assume that the proportion of those born in the five years preceding 4/1/55 who were residents of the state on that date is the same as the proportion of those born in the five years preceding 4/1/55 who were residents of the state on that date is the same as the proportion of those born in the five years preceding 4/1/50 who were, in fact, residents of the state as shown by the 1950 Census enumeration, (corrected for underenumeration). The distribution of the estimated total 0-4 by sex was made in proportion to the sex ratio of the 1950 Census age grouping, 0-4 years of age.

For 1965, the numbers 0-4 were estimated for both sexes as the mean of the projected numbers 0-4 in 1960 and 1970.

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[34/] Derived from Vital Statistics--Special Reports--Selected Studies, v. 45, No. 9, Oct. 13, 1956.

(2) Age 0-4. Total numbers, (male and female) 0-4 were projected for both 1960 and 1970 by applying the estimated 1955 fertility ratio for each state to the projected numbers of females aged 15-44 years in each projection year. The 1955 fertility ratio for each state required for computation an estimate of the numbers (male and female) 0-4 in 1955, and an estimate of the numbers of females 15-44 in 1955. The first figure was already at hand.[35] The second was computed by applying five-year 1949-1951 survival rates for each state to the numbers of females enumerated in 1950 as aged 10-14, 15-19.... 35-39 and applying estimated five-year migration components which were taken as ½ the ten-year migration components for each age grouping for the 1950-1960 decade. Dividing the numbers of children under 5 years by the numbers of women 15-44 years results in the estimated 1955 fertility ratio. Multiplying the projected numbers of women 15-44 years of age in 1960 or 1970 produces the projected number of children 0-4 in those years. Distribution by sex was in proportion to the 1950 sex ratio, 0-4 years, for each state.

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[35] See preceding subsection, "Ages 5-9."

# PART II

## LABOR FORCE PROJECTIONS

### A. Introduction

State labor force projections are obtained by multiplication of the estimates of population 14 years of age and over by the projected labor force participation rates for the appropriate age and sex groups. The population estimates for the six New England states as developed in Part I of this report were used unchanged, except that the 14 year olds were separated from the 10-14 age group [36] and added to the 15-19 year olds.

The basic procedure used to project the labor force participation rates by age and sex groups for each state was to adjust national trends in accordance with the particular labor force characteristics of each state. It will be shown that available empirical data is highly inadequate for the purposes of state projections of participation rates, and that consequently heavy reliance must be placed upon national projections. The available national projections were therefore tested in light of recent experience and, for reasons described in the following section, a new national projection was prepared for 1960.

In the remaining two sections of Part II the problems and techniques used in adjusting the national projections to the circumstances of each New England state are described. It will be pointed out that the participation rates for women and youth are particularly sensitive to demand changes, but that unfortunately no such demand projections are available for incorporation in the analysis. In the migration component of the population projections, it is true that the assumption of a continuation of prior migration patterns implies an undefined (and perhaps undefinable) demand projection. However, that demand function, even if isolated, could be consistent with a variety of assumptions concerning the demand for those relatively immobile sources of labor supply--women and youth--and it is that demand which is most relevant to their labor force participation rates. In the absence of such information, reliance must be placed upon past empirical relationships.

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[36] On the basis of one-fifth of the 10-14 population.

## B. National Projections

Both the U. S. Bureau of the Census and the U. S. Bureau of Labor Statistics have recently prepared projections of labor force participation rates to 1975 for the U. S. as a whole by sex and age groups.[37] Each of the projections defines labor force participation rates as the ratio of the total labor force (i.e., including the armed forces) to the total population (i.e., including residents of institutions). This definition differs from that used in the Monthly Report of the Labor Force of the Bureau of the Census, where only the noninstitutional population is compared with the labor force. Each projection also refers to the average monthly participation rates, and thus neither is comparable with U. S. Census of Population of 1950 which refers to the first week of April only. Although the divergence of the April participation rate of the labor force from the annual monthly average is slight,[38] there are likely to be significant differences for those age and sex groups with a strong seasonality; for example, males and females 14—19 years of age. It should also be noted that neither of the projections nor the 1950 U. S. Census is consistent with the 1940 U. S. Census data on labor force. Not only were there certain omissions and misclassifications in that census, but since July 1945, there have been changes in the definition of current labor force estimates.[39]

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[37] U. S. Bureau of the Census, Projections of the Labor Force in the United States, 1955 to 1975, Current Population Reports, Labor Force, Series P. 50, No. 69 (October, 1956). Sophia Cooper, "Labor Force Projections to 1975," Monthly Labor Review, Vol. 80, No. 12, (December, 1957), pp. 1443-1450. The 1960 and 1970 projected participation rates are contained in Sophia Cooper, Some New Dimensions in Labor Force Projections, a paper presented to the American Statistical Association, September 11, 1957 (mimeo).

The Bureau of the Census prepared four projections (see Table II-1),[40] briefly described as follows:[41]

Projection I is based upon an extrapolation of trends in the average annual rates of change in labor force participation rates from 1920 to the average of April 1954, 1955, and 1956 by sex and age groups.

Projection II is an extrapolation of average annual rates of change in labor force participation rates from 1950 to 1955. Allowance is also made for the effect of projected changes in the marital status of women on participation rates.

Projection III is a combination of Projections I and II. Projection II is used for males 14—24 years and females 14—34, and Projection

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[38] The seasonal adjustment factor for the civilian labor force used by the Census for April, 1957 and 1958, is 98.7; that is, April statistics understate the annual average by about 1.3%. See Bureau of the Census, Annual Report on the Labor Force, 1957, p. 50, No. 85 (June, 1958), p. 16.

[39] See John D. Durand, The Labor Force in the United States, 1890-1950, New York, Social Science Research Council, 1948, pps. 11-12 and Appendix A, esp. pps. 200-203, 205-207.

[40] Projection IV is not included in Table I, since the rates are identical with 1955 except for the 14-19 year olds, for reasons stated later. The projected participation rate for males of this age group is 48.6 in 1960 and 49.2 in 1970, and for females 29.6 and 29.9.

[41] For detailed explanations, see Bureau of the Census, Projections..., op. cit., pp. 8-11.

I for all others.

Projection IV is a continuation of 1955 rates without change. For the age group 14-19, separate projections are made for the groups 14-15, 16-17, and 18-19 years.

The Bureau of Labor Statistics projection, as shown in Table II-1, is consistent with the census projections but involves certain modifications based upon recent trends in school enrollment of persons 14—24, in labor force participation of women in terms of marital status and presence of young children, and among employment of older workers.[42/] The projection assumes high levels of full employment, no significant change in the size of the Armed Forces, and sufficient expansion of educational facilities to meet increasing school enrollments.[43/]

To test these national projections, trends in labor force participation rates based on actual experience were calculated for the period 1950 to the average of the three years, 1955, 1956, and 1957[44/] and extrapolated to 1960. Since these rates were based upon the noninstitutional population, they were adjusted to a comparable basis with the national projections (which referred to total population) by the use of the two sets of rates for 1955. (See Table II-2). The corrected projection for 1960, based on 1950 to 1955-57 trends was then compared with the B.L.S. and the Census Projections I, II, and III. As shown in Table II-3, the national projections were generally below the new estimates, although there was variation among certain age groups.

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[42/] Cooper, op. cit., pp. 6-8.

[43/] Ibid., pp. 8-9. These assumptions are included, some implicitly, in the Census projections.

[44/] See Bureau of the Census, Annual Report on the Labor Force, 1956, p. 50, No. 72, Table B, p. 3, and Annual Report, 1957, op. cit., Table B, p. 5.

## Table II-1

## Projections of U.S. Total Labor Force Participation Rates by Sex and Age to 1960 and 1970

(Prepared by
U.S. Bureau of Census and U.S. Bureau of Labor Statistics)

| | 1955 | 1960 | | | | 1970 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Actual | Census | | | BLS | Census | | | BLS |
| | | I | II | III | | I | II | III | |
| **Male** | 82.3 | 81.0 | 80.7 | 80.7 | 80.9 | 78.7 | 77.9 | 77.9 | 78.6 |
| 14-19 | 49.0 | 47.5 | 46.0 | 46.0 | 47.9 | 44.7 | 41.9 | 41.9 | 46.7 |
| 20-24 | 89.5 | 89.3 | 88.2 | 88.2 | 88.1 | 88.9 | 85.7 | 85.7 | 86.3 |
| 25-34 | 96.5 | 96.5 | 96.8 | 96.5 | 96.5 | 96.6 | 97.3 | 96.6 | 96.5 |
| 35-44 | 96.9 | 96.9 | 97.3 | 96.9 | 96.9 | 97.0 | 98.0 | 97.0 | 96.9 |
| 45-54 | 95.1 | 95.2 | 95.7 | 95.2 | 95.1 | 95.5 | 96.7 | 95.5 | 95.1 |
| 55-64 | 86.4 | 86.3 | 87.4 | 86.3 | 86.4 | 86.1 | 89.2 | 86.1 | 86.4 |
| 65 & over | 38.5 | 36.5 | 33.4 | 36.5 | 36.0 | 32.8 | 25.1 | 32.8 | 32.2 |
| **Female** | 34.5 | 35.9 | 36.5 | 35.6 | 36.4 | 38.5 | 39.8 | 37.5 | 38.4 |
| 14-19 | 29.7 | 29.2 | 28.7 | 28.7 | 28.6 | 28.3 | 27.6 | 27.6 | 27.9 |
| 20-24 | 45.8 | 47.6 | 46.5 | 46.5 | 45.4 | 50.9 | 46.6 | 46.6 | 45.2 |
| 25-34 | 34.8 | 36.9 | 35.8 | 35.8 | 37.9 | 40.8 | 38.0 | 38.0 | 38.9 |
| 35-44 | 41.4 | 44.2 | 44.0 | 44.2 | 43.0 | 49.3 | 48.7 | 49.3 | 47.0 |
| 45-54 | 43.5 | 46.1 | 49.2 | 46.1 | 48.2 | 51.0 | 58.8 | 51.0 | 54.5 |
| 55-64 | 32.2 | 34.4 | 37.5 | 34.4 | 37.4 | 38.7 | 46.2 | 38.7 | 43.0 |
| 65 & over | 10.3 | 10.6 | 11.1 | 10.6 | 11.0 | 11.1 | 12.7 | 11.1 | 12.2 |

Source: See text for references.

For males, Census Projection I is within one percent for all age groups, except the 65 and over category where there is an overestimate of 8.6%. Census Projection II is within one percent for ages 25 and over, but understates the 14—19 age groups by 3.6% and the 20-24 age group by a 2.2%. All three of these age groups with the greatest deviation are included in Projection III. The B.L.S. projection contains two age groups with a deviation of more than one percent, the 20-24 and 65 and over age groups. The best fit of all projections is Projection I, or the projection based on the long term trend from 1920 to April 1954, 1955, and 1956, if the 65 and over age group is excluded.

For females, projections again generally underestimate the trends in labor force participation in comparison with the new projection. Census Projection I understates from 3.0% to 10.0% for all age groups, except 20-24 and 25-34 years. In both of these cases there is an overestimate, of 3.7% in the former and of 2.2% in the latter. Census Projection II overestimates slightly the trends in the age group 20-24 and 65 and over, although the deviations are substantially less than in Projection I.[45]

Projection III falls somewhat between I and II. The B.L.S. projections range from plus 4.9% to minus 6.2%, with, again, a conspicuous tendence to understate female participation rates.

The new projection based upon 1950 to 1955-1957 should not, of course, be considered as a necessarily better projection of 1960 than those already published. However, there are two advantages in using this projection rather than the published ones. It is based upon data

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[45] The sum of the deviations, plus and minus are I, .346; II, .151; III, .327; B.L.S., .226.

## Table II-2

## 1960 Projection of U.S. Participation Rates based upon Experience 1950 to 1955-57, Adjusted to Comparable Basis with Census and BLS Projections.

| | 1955 Rates | | | | |
|---|---|---|---|---|---|
| | Total Pop. (1) | Non Inst. Pop. (2) | Correction Factor Col. 1÷2 (3) | New Projection for 1960 (4) | Corrected Projection 1960 Col. 3 x 4 (5) |
| **Male** | | | | | |
| 14-19 | 49.0 | 49.5 | .989 | 48.2 | 47.7 |
| 20-24 | 89.5 | 90.8 | .985 | 91.4 | 90.1 |
| 25-34 | 96.5 | 97.7 | .987 | 98.3 | 97.0 |
| 35-44 | 96.9 | 98.1 | .987 | 98.3 | 97.0 |
| 45-54 | 95.1 | 96.5 | .985 | 97.0 | 95.5 |
| 55-64 | 86.4 | 87.9 | .982 | 88.7 | 87.1 |
| 65 & over | 38.5 | 39.6 | .972 | 34.5 | 33.6 |
| **Female** | | | | | |
| 14-19 | 29.7 | 29.9 | .993 | 30.3 | 30.1 |
| 20-24 | 45.8 | 46.0 | .995 | 46.2 | 45.9 |
| 25-34 | 34.8 | 34.9 | .997 | 36.2 | 36.1 |
| 35-44 | 41.4 | 41.6 | .995 | 46.0 | 45.8 |
| 45-54 | 43.5 | 43.8 | .993 | 50.1 | 49.8 |
| 55-64 | 32.2 | 32.5 | .990 | 38.6 | 38.2 |
| 65 & over | 10.3 | 10.6 | .971 | 11.3 | 11.0 |

## Table II-3

## National Projections for 1960 Compared with Projection of 1950 to 1955-57 Trends*

| | Census Projections | | | BLS |
|---|---|---|---|---|
| | I | II | III | |
| **Male** | | | | |
| 14-19 | .996 | .964 | .964 | 1.004 |
| 20-24 | .991 | .978 | .978 | .977 |
| 25-34 | .994 | .997 | .994 | .994 |
| 35-44 | .998 | 1.003 | .998 | .998 |
| 45-54 | .996 | 1.002 | .996 | .995 |
| 55-64 | .990 | 1.003 | .990 | .991 |
| 65 & over | 1.086 | .994 | 1.086 | 1.071 |
| **Female** | | | | |
| 14-19 | .970 | .953 | .953 | .950 |
| 20-24 | 1.037 | 1.013 | 1.013 | .984 |
| 25-34 | 1.022 | .991 | .991 | 1.049 |
| 35-44 | .965 | .960 | .965 | .938 |
| 45-54 | .925 | .987 | .925 | .967 |
| 55-64 | .900 | .981 | .900 | .979 |
| 65 & over | .963 | 1.009 | .963 | 1.000 |

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* Rates for 1960 in Table II-1 divided by new projection, Table II-2, column 5.

through a later year, 1957, which presumably would give a more assured indication of trends for the current decade. Secondly, the projection is more firmly based by using the three years of 1955-1957, than projections from 1950 to 1955 (Census II) or to the Aprils of 1953-1956 (Census I). In the first case, the influence of the Korean War during 1950 and of the relatively low level of economic activity during 1955 could mean that cyclical influences on participation rates would distort trends. In the second case, the use of April data for the three years improves this situation somewhat, but it can be argued that the average of these years also tend to represent relatively lower levels of economic activity,[46/] than the annual averages of the 1955-1957 period.

If the 1950 to 1955-1957 trends are used to project 1960 labor force participation rates, what basis should be used for projecting 1970 rates? Can it be assumed that the published projections that best fit the experience so far during the 1950's should be used for projecting to 1970? If so, this would mean the use of Projection I for males (with the exception of the 65 and over age group) and Projection II for women. The use of the 1950-1955 trend Projection (II) for women instead of the longer-run trends of Projection I could be justified on the grounds that the post-World War II period seems to be marked clearly by an upward shift in participation rates from long-run trends

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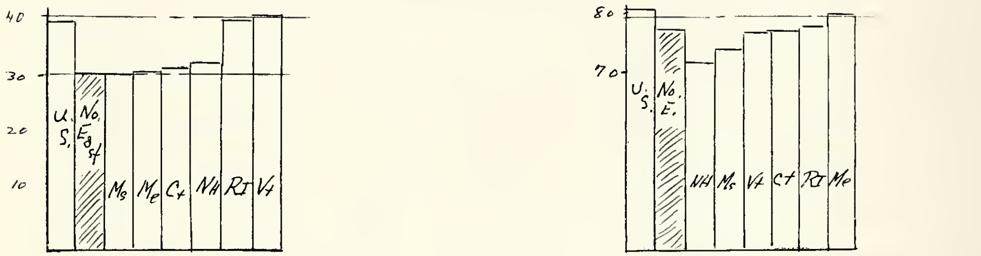
[46/] A further point in that the seasonal adjustment factors for the Aprils of the three years 1954, 1955 and 1956 were 99.0, 99.1 and 98.9, or the highest of any years from 1957 to 1958. This compares with 98.5 in 1950. See U. S. Bureau of the Census, Seasonal Variations in the Labor Force, Employment and Unemployment, Series p. 50, No. 82 (April 1958), Table D, p. 6.

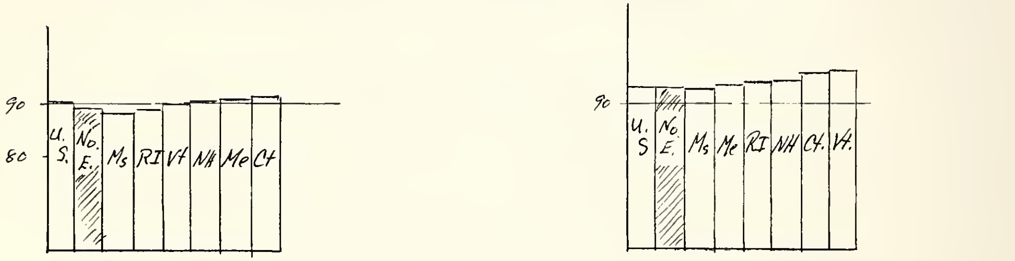
# CHART I. LABOR FORCE PARTICIPATION RATES BY AGE AND SEX, APRIL, 1950

## A. MALES



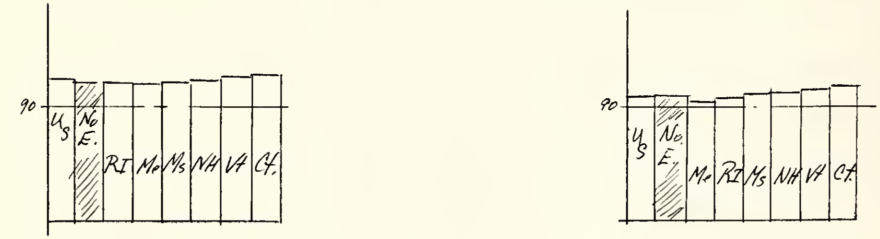
14-19 Age Group

20-24 Age Group



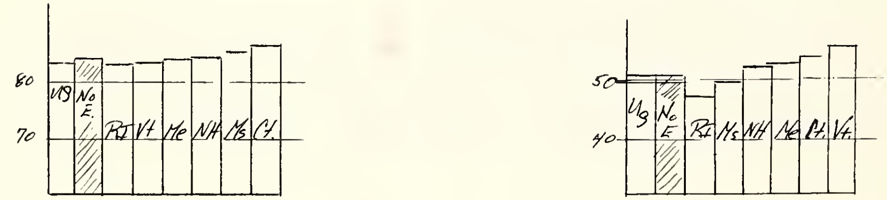
25-29

30-34



35-44

45-54

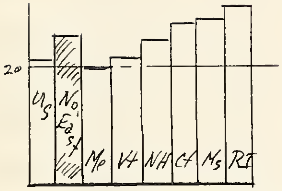


55-64

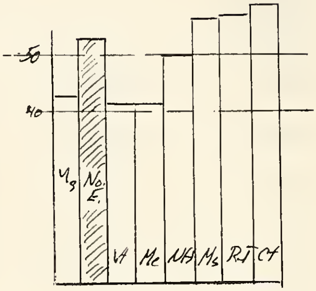
65-74

# CHART I (Continued)

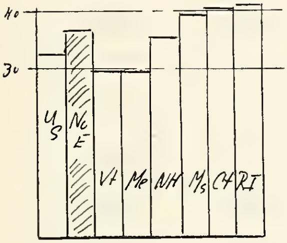
## B. Females



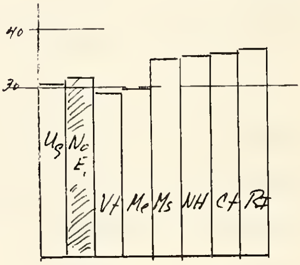
14 to 19 Age Group



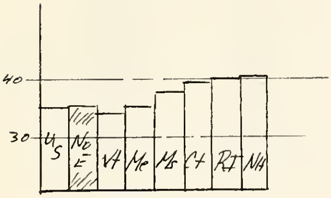
20 to 24 Age Group



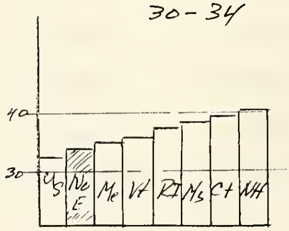
25-29



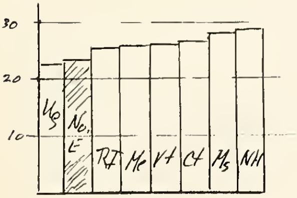
30-34



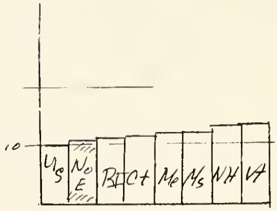
35-44



45-54



55-64



65-74

## Table II-4

## Census and BLS Projections of Labor Force Participation Rates - Ratio of 1970 to 1960 Rates by Age and Sex Groups

| Age 17 Years | Census<br>I | <br>II | <br>III | BLS |
|---|---|---|---|---|
| **Male** | | | | |
| 14-19 | .941 | .910 | .910 | .974 |
| 20-24 | .995 | .971 | .971 | .979 |
| 25-34 | 1.001 | 1.005 | 1.001 | 1.000 |
| 35-44 | 1.001 | 1.007 | 1.001 | 1.000 |
| 45-54 | 1.003 | 1.010 | 1.003 | 1.000 |
| 55-64 | .997 | 1.020 | .997 | 1.000 |
| 65 & over | .898 | .751 | .898 | .894 |
| **Female** | | | | |
| 14-19 | .969 | .961 | .961 | .975 |
| 20-24 | 1.069 | 1.002 | 1.002 | .995 |
| 25-34 | 1.105 | 1.061 | 1.061 | 1.026 |
| 35-44 | 1.115 | 1.106 | 1.115 | 1.093 |
| 45-54 | 1.106 | 1.195 | 1.106 | 1.130 |
| 55-64 | 1.125 | 1.232 | 1.125 | 1.149 |
| 65 & over | 1.047 | 1.144 | 1.047 | 1.109 |

for age groups 45 years of age and over, and a downward shift for age groups under 45 because of the greater number of women with young children.

But can it be assumed that the trends of the 1950's will continue to 1970? (See Table II-4). The B.L.S. 1970 projections would seem to offer a reasonable compromise on a variety of assumptions. With regard to male participation rates, the B.L.S. 1970 projections conform closely with Projection I by age groups, with the exception of the under 25 age group. For females, the B.L.S. 1970 projections tend either to follow Projection II, or modify specific age group estimates generally in the direction of Projection II.

Additional reasons for the use of the B.L.S. projections from 1960 to 1970 are as follows:

1. The B.L.S. assumption that the effect of a projection of an increasing rate of school enrollment during the 1960's will be modified by a rising rate of part-time employment[47/] seems to be justified in terms of recent experience.

2. A farm-non-farm breakdown, which was incorporated in projections of male workers, should improve estimates, particularly with 65 and over age group.[48/]

3. The assumption that female participation rates will continue to rise but not at the rate of the 1950's seems reasonable. "For one thing, their rates (of adult women) will be quite high by 1965 and will have been raised to that point by the addition of many women whose work

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[47/] Cooper, op. cit., pp. 1445-1446.

[48/] Ibid., p. 1446.

activity is marginal in the sense of not being full time or full year and depends to some extent upon labor demand rather than on economic necessity alone."[49]

## C. State Labor Force Projections

Preparation of projections of labor force by states imposes additional problems to those of national projections. Current estimates of participation rates by age and sex for states are lacking, so that reliance must be placed primarily on census data. As the time since the last census increases, such reliance becomes less and less satisfactory. In addition, census data, which refer to only one week in the census year, give no basis for the separation of seasonal changes in labor force participation rates from long-run trends. Seasonal variation is minimized by using the same week in census years but not eliminated, since seasonal patterns may change over time. Unfortunately data on such changes are not available.

An even more significant problem is that changes in the demand for labor may alter labor force participation rates. As already noted, both the Census and the Bureau of Labor Statistics were careful to point out that their national projections were made on the assumption of high levels of economic activity. The Bureau of Labor Statistics also emphasized demand factors in connection with estimates of part-time workers. For states, the problem of the impact of demand upon labor force participation rates is magnified by the mobility, and lack of mobility, of labor.

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49/ Ibid., p. 1448.

For example, if the total demand for labor should be increased beyond the existing labor supplies in a particular area, three types of adjustment could take place: (1.) New workers might be attracted from the existing local population; (2.) workers might move into the area; and (3.) workers might commute to these jobs from other areas. In the first case, there would be a net increase in the size of the labor force and a rise in labor force participation rates. In the second case, there would be no change in participation rates but an increase in the area's labor force. In the third case, the area would experience neither a change in participation rates, nor an increase in labor force, since labor force statistics classify workers by place of residence and not by place of work. From the point of view of the areas that supply labor, out-migration would, of course, reduce the size of the labor force but not participation rates, while commuting to areas of demand would have no affect on the size of its labor force by definition, or on its participation rates assuming that these workers were already in the labor force as unemployed workers.

The fact that a change in labor demand may theoretically lead either to a change or no change in participation rates, and to a change or no change in the number in the labor force, at first sight seems to impose an insuperable problem to labor force analysis.

Fortunately this is not entirely the case, In Chart I-A and I-B, the differing labor force participation rates, by sex and age groups, for the New England states are compared with the United States average and with the highest and lowest state rates in 1950. Table II-5 present indices of these rates. One pattern seems to emerge rather clearly from the data. For males, 25 to 55 years of age, the range between high and low rates is extremely narrow. This is the "hard core"

Table II-5

## Indices of Labor Force Participation Rates By Age and Sex Groups for New England States and Highest and Lowest State Rates for April, 1950

(U.S. equals 100.0)

| Sex and Age | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Males | High | Low | Me. | N.H. | Vt. | Mass. | R.I. | Ct. |
| 14-19 | 137.9 | 71.2 | 78.3 | 82.9 | 102.5 | 77.9 | 99.5 | 79.6 |
| 20-24 | 108.1 | 88.7 | 98.7 | 88.7 | 94.1 | 90.7 | 96.0 | 94.5 |
| 25-29 | 103.7 | 94.3 | 100.7 | 100.2 | 99.8 | 97.7 | 98.8 | 100.9 |
| 30-34 | 102.4 | 97.6 | 100.2 | 100.7 | 101.8 | 99.8 | 100.4 | 101.6 |
| 35-44 | 101.9 | 97.4 | 99.8 | 100.5 | 100.7 | 100.1 | 99.8 | 101.0 |
| 45-54 | 102.6 | 93.6 | 99.1 | 100.5 | 100.9 | 100.1 | 99.5 | 101.7 |
| 55-64 | 105.1 | 87.8 | 99.8 | 100.2 | 99.7 | 101.8 | 99.4 | 103.8 |
| 65-74 | 119.6 | 78.2 | 102.7 | 103.1 | 108.1 | 96.9 | 92.0 | 105.3 |
| 75 & over | 156.9 | 70.4 | 102.6 | 103.7 | 115.5 | 88.2 | 84.9 | 94.1 |
| Female | | | | | | | | |
| 14-19 | 140.2 | 56.6 | 92.0 | 115.5 | 100.9 | 128.5 | 140.2 | 125.2 |
| 20-24 | 138.1 | 64.5 | 96.1 | 115.3 | 94.9 | 131.0 | 131.3 | 135.9 |
| 25-29 | 173.3 | 66.8 | 90.2 | 109.5 | 89.6 | 119.6 | 124.8 | 124.5 |
| 30-34 | 188.9 | 65.3 | 95.1 | 112.3 | 92.2 | 110.4 | 119.4 | 113.6 |
| 35-44 | 174.8 | 69.4 | 101.1 | 117.1 | 98.6 | 107.7 | 114.3 | 114.0 |
| 45-54 | 179.6 | 66.2 | 106.7 | 121.9 | 107.9 | 115.5 | 112.8 | 120.4 |
| 55-64 | 176.0 | 66.2 | 112.4 | 122.6 | 112.4 | 120.5 | 111.5 | 114.5 |
| 65-74 | 162.1 | 64.0 | 118.4 | 132.0 | 133.0 | 118.4 | 113.6 | 116.5 |
| 75 & over | 153.8 | 50.0 | 138.5 | 150.0 | 134.6 | 100.0 | 103.8 | 126.9 |

of the labor force. The range widens in both the younger and older age groups. For females, a substantial range exists throughout the age brackets.

The hypothesis presented here is that labor demand particularly for women is a most significant factor in the wide variation of their participation rates, because of the relative immobility of these population groups. If there is an increased demand for this type of labor, there will likely be an increase in their participation rates. Areas with industries which employ women, such as services, or light manufacturing, for example, tend to have higher women rates than areas with farming, or heavy industry, which employ fewer women. Whether an increase in demand in a particular area will lead to a rise in participation rates or to in-migration will depend upon the type of labor demanded and upon what level of participation rates already exists within the area.50/

One additional element in the analysis of demand relates to the urban-rural classification of labor force. Charts II-A and II-B indicate nationally the variation in participation rates by age groups of population classified as urban, rural nonfarm, and rural farm. The structure of urban demand clearly favors higher participation rates for women and lower rates for males. Rural-farm areas indicate a greater demand for male youth than urban areas, although in this case relative educational incentives and opportunities are also pertinent.

## D. Projection Procedure

Since projections of demand by amount, location and types of labor

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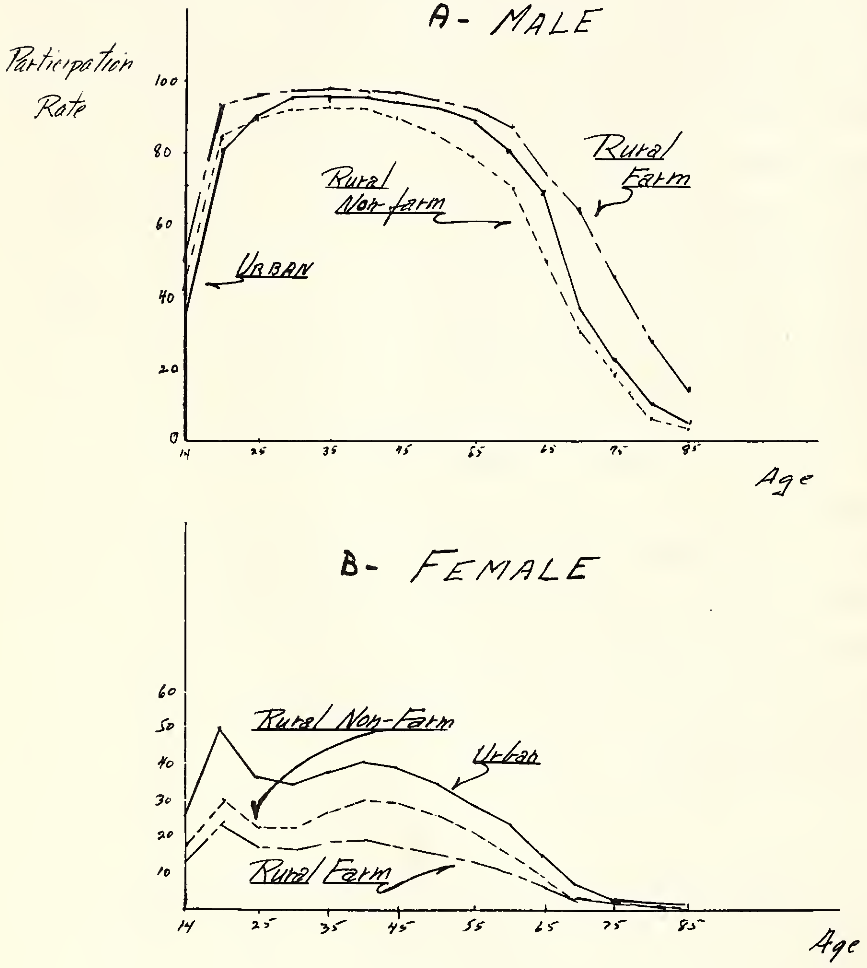
50/ The amount of commuting that might result will, of course, reflect the availability of labor within the commuting range. Although the problem of estimating the amount of commuting over state lines may be relevant to certain areas of New England, it is neglected in the estimates presented in this paper; that is, the estimates assume that existing interstate commuting patterns will not be substantially modified.

# CHART II

# U.S. LABOR FORCE PARTICIPATION RATES
## by
## URBAN, RURAL NON-FARM, and RURAL FARM
## April, 1950



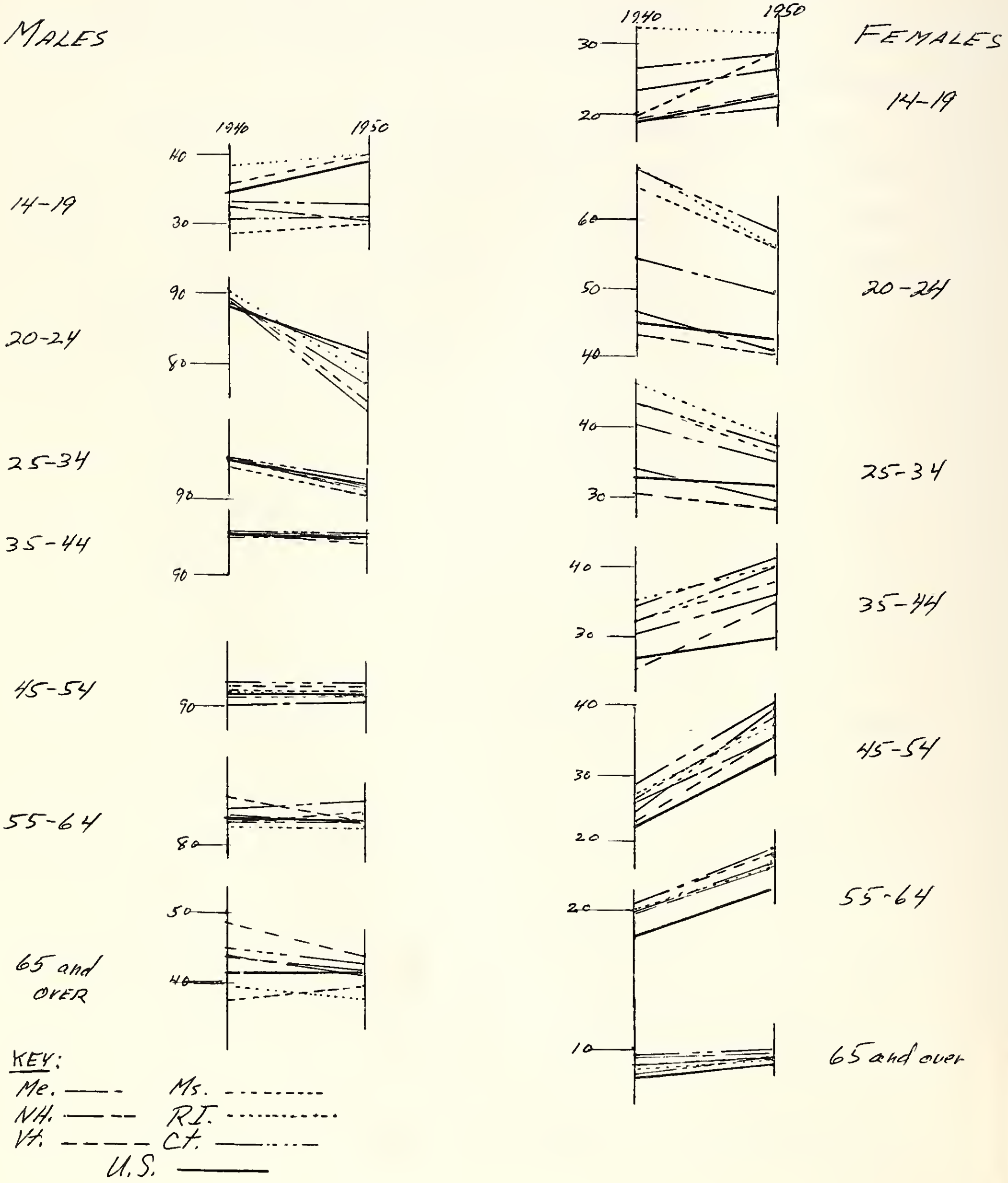
required are not available, and since the population projections already include migration estimates, the only basis remaining for consideration of future participation rates is in terms of the limits of variations among the states, historical trends in state rates, and the national projection.

In the case of male labor force projections, there is no reason not to use the national projections for age groups 25-54. Not only is the range of variation small, but from 1940 to 1950 state rates moved closely with the national averages. (See Chart III).

For the younger age group, 14—19 , two states Vermont and Rhode Island, were close to the national average, while the other four were substantially below, with rates ranging from 77.9% to 82.9% of the U. S. average. (See Table II-5). Since these ratios are in the lowest fourth of the range of states, and since the national projections assume a decline of some 2% and 4% from 1950 to 1960 and from 1960 to 1970 respectively, it seems reasonable to consider this trend inapplicable to these four states. Therefore, their rates are assumed to be unchanged, while the rates for Vermont and Rhode Island are moved in accordance with the national projection. From 1940 to 1950, the labor force rate in no one of the four states singled out here as an exception moved to the extent to which the national rate changed. (Chart III).

For males 20-24 years of age, a different situation holds. The range of rates in 1950 among all states was from 8.1% above to 11.3% below the national average, the lowest state, being New Hampshire. All New England states were below the national average although in 1940 they were all slightly above. Since the national projection shows a slight upward trend to 1960 and then a downward trend to 1970, it

# CHART III. TRENDS IN PARTICIPATION RATES, 1940 to 1950, NEW ENGLAND STATES, AGE and SEX



would seem unreasonable to apply the national rate to those states with lowest rates, Massachusetts and New Hampshire, particularly in the period 1960 to 1970. Consequently, in the period to 1960 the rates of all six states were assumed to rise in accordance with national projection, but the slight projected decline during the 1960's was assumed to apply to the four states other than Massachusetts and New Hampshire.

For males 55 to 64, the national range of rates was from 5.1% above to 12.2% below the national average. However the range of New England states was from 3.8% above to 0.6% below. For this age group, there seems to be no reason not to use the changes indicated in the national projections.

For the male age group 65 and over, the downward projection of rates seems excessive at least for New England states. Undoubtedly, the national projection reflects, in part, a continuing movement from rural to urban areas, where these rates tend to be lower, and in part the effect of expansion of retirement and pension programs. Since a significant movement from rural to urban areas within the New England states does not seem as likely as in areas of the south and west, the compromise used here is to take only one-half of the projected national change to apply to this age group.

For women, projection of labor force participation rates presents somewhat greater problems due to the diversity in rates by states. (See Table II-5 and Chart I-B). All New England states have rates that exceed the national averages in all age groups, except in the case of Maine for ages 14—34, are in Vermont for ages 20-30.

By specific age groups, the procedure followed for state projections was as follows. For the age group, 14-19, the state of Rhode Island had the highest rate in the United States, while Massachusetts, along with Minnesota, held second place, and Connecticut was close behind. The fact that these rates were so high in 1950, however, does not seem to justify any modification of the slight downward trend in the national projections. Presumably, the structure of jobs that favored women would still exist and would give a continuing opportunity for high rate of participation. For Maine, the only state below the national average (-8.0%), the participation rate for this group was held constant against the downward national trend, while the Vermont rate was held constant from 1960 to 1970.

For the 20-24 year age group, there is also a wide variation in rates, with only Vermont and Maine falling below the national average. However, since the national projections indicate only a slight percentage change from 1950 to 1960, and from 1960 to 1970, there seems to be no apparent reason to assume a trend different from the national one.51/

Different circumstances pertain to the 25-34 year age group, since the national projection assumes a steadily rising participation rate. With the southern states of New England, followed by New Hampshire, considerably above the national average can it be assumed that their rates would increase in the same proportion? They are considerably below the maximum rates of the District of Columbia and Florida, but the special conditions in those two states would not be duplicated in New England. Only half of the national rate of increase is therefore applied in these cases for the period 1950 to 1960.

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51/ In the case of Vermont and Maine, an increase from the demand side for women in this age category would certainly lead to a rise in participation rates.

For the female age group, 35-44, a similar modification is arbitrarily made for trends in the participation rates of New Hampshire, Rhode Island and Connecticut, where rates ranged from 14.0% to 17.1% above the national average in 1950.

In the 45-54 and 55-64 age groups, the national projections indicate the greatest absolute and relative increase in participation rates from 1950 to 1970. All New England states in 1950 had rates higher than the U. S. average, and similarily all New England states experienced a rapid rise in rates during the decade of the 1940's. It is proposed, again, to apply arbitrarily here only one-half of the national rate of increase to all six states for these two age groups.

For the 65 and over category, the national trend upward to 1970 is slight. Since the rates in the six states moved together during the 1940's, the trend of the national projection was applied to each of them.

The April 1960 and 1970 projected participation rates by age and sex for each of the six New England states and all of New England and the projected labor force (population times the rate) are presented in Table II-6.

Table II-6A

## Projections of Labor Force and Participation Rates, April 1960 and April 1970, By Age and Sex

## Maine

| Age & Sex | 1950<br>LFPR% | 1950<br>Labor Force | 1960<br>LFPR% | 1960<br>Labor Force | 1970<br>LFPR% | 1970<br>Labor Force |
|---|---|---|---|---|---|---|
| **Males** | | | | | | |
| 14-19 | 30.8 | 12,745 | 30.8 | 14,590 | 30.8 | 18,037 |
| 20-24 | 80.9 | 26,330 | 83.1 | 18,612 | 81.4 | 32,231 |
| 25-34 | 92.5 | 56,870 | 94.5 | 45,588 | 94.5 | 42,170 |
| 35-44 | 94.4 | 53,310 | 95.0 | 58,476 | 95.0 | 44,615 |
| 45-54 | 91.2 | 44,180 | 92.3 | 49,130 | 92.3 | 53,303 |
| 55-64 | 83.3 | 32,935 | 84.9 | 33,125 | 84.9 | 38,827 |
| 65 & over | 41.0 | 17,665 | 35.9 | 16,584 | 34.0 | 16,604 |
| Total | 73.5 | 244,035 | 73.7 | 236,105 | 71.9 | 245,787 |
| Index (1950=100.0) | | 100.0 | | 97.6 | | 100.7 |
| **Females** | | | | | | |
| 14-19 | 20.8 | 8,740 | 20.8 | 9,957 | 20.8 | 12,044 |
| 20-24 | 41.2 | 14,360 | 41.2 | 10,829 | 41.0 | 16,720 |
| 25-34 | 29.4 | 19,060 | 31.3 | 17,635 | 32.1 | 17,508 |
| 35-44 | 35.4 | 21,015 | 41.7 | 26,561 | 45.6 | 25,297 |
| 45-54 | 35.1 | 18,265 | 40.7 | 22,854 | 43.3 | 26,402 |
| 55-64 | 26.3 | 11,030 | 31.9 | 14,318 | 34.3 | 17,169 |
| 65 & over | 9.0 | 4,460 | 10.4 | 5,690 | 11.6 | 7,069 |
| Total | 28.3 | 96,930 | 30.8 | 107,844 | 32.1 | 122,209 |
| Index (1950=100.0) | | 100.0 | | 111.3 | | 126.1 |
| Total Males and Females | 50.5 | 340,965 | 51.6 | 343,949 | 50.9 | 367,996 |
| Index (1950=100.0) | | 100.0 | | 101.5 | | 107.9 |

Table II-6B

## Projections of Labor Force and Participation Rates, April 1960 and April 1970, By Age and Sex

New Hampshire

| | 1950 | | 1960 | | 1970 | |
|---|---|---|---|---|---|---|
| Age & Sex | LFPR% | Labor Force | LFPR% | Labor Force | LFPR% | Labor Force |
| Males | | | | | | |
| 14-19 | 32.6 | 7,345 | 32.6 | 9,047 | 32.6 | 11,280 |
| 20-24 | 72.7 | 13,760 | 74.7 | 13,037 | 74.7 | 19,787 |
| 25-34 | 92.5 | 33,525 | 94.6 | 32,569 | 94.6 | 34,422 |
| 35-44 | 95.0 | 32,605 | 95.6 | 35,221 | 95.6 | 32,566 |
| 45-54 | 92.5 | 28,020 | 93.6 | 31,774 | 93.6 | 33,479 |
| 55-64 | 83.6 | 20,330 | 85.2 | 22,902 | 85.2 | 25,006 |
| 65 & over | 41.3 | 10,425 | 36.2 | 11,017 | 34.3 | 11,338 |
| Total | 74.0 | 146,010 | 74.9 | 155,567 | 73.1 | 167,878 |
| Index (1950=100.0) | | 100.0 | | 106.5 | | 115.0 |
| Females | | | | | | |
| 14-19 | 26.1 | 5,910 | 25.1 | 6,855 | 24.5 | 8,391 |
| 20-24 | 49.8 | 9,730 | 49.9 | 8,891 | 49.6 | 13,096 |
| 25-34 | 35.2 | 13,605 | 36.3 | 13,009 | 37.3 | 13,875 |
| 35-44 | 41.0 | 14,750 | 44.6 | 17,781 | 46.7 | 17,196 |
| 45-54 | 40.1 | 12,910 | 46.5 | 16,916 | 49.5 | 19,514 |
| 55-64 | 28.7 | 7,895 | 34.9 | 10,371 | 37.5 | 12,547 |
| 65 & over | 9.9 | 3,120 | 11.6 | 4,402 | 12.8 | 5,604 |
| Total | 32.7 | 67,920 | 34.8 | 78,225 | 35.9 | 90,223 |
| Index (1950=100.0) | | 100.0 | | 115.2 | | 132.8 |
| Total Males and Females | 52.8 | 213,930 | 54.2 | 233,792 | 53.7 | 258,101 |
| Index (1950=100.0) | | 100.0 | | 109.3 | | 120.6 |

## Table II-6C

## Projections of Labor Force and Participation Rates, April 1960 and April 1970, By Age and Sex

## Vermont

| | 1950 | | 1960 | | 1970 | |
|---|---|---|---|---|---|---|
| Age & Sex | LFPR% | Labor Force | LFPR% | Labor Force | LFPR% | Labor Force |
| **Males** | | | | | | |
| 14-19 | 40.3 | 7,005 | 36.5 | 6,979 | 35.5 | 8,775 |
| 20-24 | 77.1 | 10,595 | 79.2 | 7,062 | 77.5 | 12,960 |
| 25-34 | 93.2 | 23,190 | 95.2 | 14,863 | 95.2 | 16,509 |
| 35-44 | 95.2 | 22,065 | 95.8 | 21,274 | 95.8 | 13,093 |
| 45-54 | 92.9 | 18,290 | 94.0 | 19,729 | 94.0 | 18,726 |
| 55-64 | 83.2 | 13,610 | 84.8 | 12,094 | 84.8 | 13,807 |
| 65 & over | 43.6 | 7,680 | 38.2 | 7,054 | 36.2 | 6,428 |
| Total | 75.1 | 102,435 | 74.5 | 89,055 | 71.5 | 90,298 |
| Index (1950=100.0) | | 100.0 | | 86.9 | | 88.2 |
| **Females** | | | | | | |
| 14-19 | 22.8 | 4,055 | 22.0 | 4,394 | 22.0 | 5,358 |
| 20-24 | 41.0 | 5,680 | 41.0 | 4,223 | 40.8 | 6,722 |
| 25-34 | 28.8 | 7,715 | 30.7 | 6,779 | 31.5 | 7,248 |
| 35-44 | 34.5 | 8,295 | 40.6 | 10,314 | 44.4 | 9,487 |
| 45-54 | 35.5 | 7,230 | 41.2 | 8,910 | 43.8 | 10,383 |
| 55-64 | 26.3 | 4,620 | 31.9 | 5,411 | 34.3 | 6,486 |
| 65 & over | 9.8 | 2,100 | 11.4 | 2,638 | 12.7 | 3,144 |
| Total | 28.1 | 39,695 | 30.6 | 42,669 | 32.0 | 48,828 |
| Index (1950=100.0) | | 100.0 | | 107.5 | | 123.0 |
| Total Males and Females | 51.1 | 142,130 | 50.8 | 131,724 | 49.9 | 139,126 |
| Index (1950=100.0) | | 100.0 | | 92.7 | | 97.9 |

Table II-6D

## Projections of Labor Force and Participation Rates, April 1960 and April 1970, By Age and Sex

## Massachusetts

| | 1950 | | 1960 | | 1970 | |
|---|---|---|---|---|---|---|
| Age & Sex | LFPR% | Labor Force | LFPR% | Labor Force | LFPR% | Labor Force |
| **Males** | | | | | | |
| 14-19 | 30.6 | 55,450 | 30.6 | 70,277 | 30.6 | 91,378 |
| 20-24 | 74.3 | 126,985 | 76.3 | 108,226 | 76.3 | 171,411 |
| 25-34 | 90.9 | 319,360 | 92.9 | 279,140 | 92.9 | 280,277 |
| 35-44 | 94.6 | 294,670 | 95.2 | 333,383 | 95.2 | 281,627 |
| 45-54 | 92.1 | 247,840 | 93.2 | 275,954 | 93.2 | 306,515 |
| 55-64 | 84.9 | 192,475 | 86.5 | 199,573 | 86.5 | 215,925 |
| 65 & over | 39.2 | 78,060 | 34.3 | 83,120 | 32.5 | 84,524 |
| Total | 75.8 | 1,314,840 | 75.4 | 1,349,673 | 73.1 | 1,431,657 |
| Index (1950 = 100.0) | | 100.0 | | 102.6 | | 108.9 |
| **Females** | | | | | | |
| 14-19 | 29.0 | 53,490 | 27.9 | 63,492 | 27.2 | 80,117 |
| 20-24 | 56.6 | 101,925 | 56.7 | 84,218 | 56.4 | 128,376 |
| 25-34 | 36.6 | 137,450 | 37.7 | 123,070 | 38.7 | 124,319 |
| 35-44 | 37.7 | 128,960 | 44.4 | 165,102 | 48.5 | 157,073 |
| 45-54 | 38.0 | 115,505 | 44.0 | 144,494 | 46.9 | 166,762 |
| 55-64 | 28.2 | 70,945 | 34.3 | 91,759 | 36.8 | 107,723 |
| 65 & over | 8.9 | 23,770 | 10.3 | 34,158 | 11.4 | 42,897 |
| Total | 33.1 | 632,045 | 35.3 | 706,293 | 36.9 | 807,267 |
| Index (1950=100.0) | | 100.0 | | 111.7 | | 127.7 |
| **Total Males and Females** | 53.5 | 1,946,885 | 54.2 | 2,055,936 | 54.0 | 2,238,924 |
| Index (1950=100.0) | | 100.0 | | 105.6 | | 115.6 |

## Table II-6E

## Projections of Labor Force and Participation Rates, April 1960 and April 1970, By Age and Sex

## Rhode Island

| Age & Sex | 1950 LFPR% | 1950 Labor Force | 1960 LFPR% | 1960 Labor Force | 1970 LFPR% | 1970 Labor Force |
|---|---|---|---|---|---|---|
| **Males** | | | | | | |
| 14-19 | 39.1 | 13,250 | 35.5 | 13,778 | 34.5 | 17,252 |
| 20-24 | 78.6 | 27,640 | 80.8 | 20,735 | 79.1 | 31,792 |
| 25-34 | 91.6 | 57,860 | 93.6 | 59,168 | 93.6 | 52,339 |
| 35-44 | 94.3 | 49,000 | 94.9 | 60,546 | 94.9 | 58,863 |
| 45-54 | 91.5 | 40,250 | 92.6 | 43,247 | 92.6 | 54,598 |
| 55-64 | 82.9 | 29,480 | 84.5 | 32,228 | 84.5 | 35,546 |
| 65 & over | 37.9 | 11,375 | 33.2 | 12,158 | 31.5 | 12,505 |
| Total | 76.1 | 228,855 | 76.5 | 241,860 | 75.4 | 262,895 |
| Index (1950=100.0) | | 100.0 | | 105.7 | | 114.9 |
| **Females** | | | | | | |
| 14-19 | 31.7 | 9,605 | 30.5 | 11,513 | 29.8 | 14,143 |
| 20-24 | 56.7 | 17,830 | 56.8 | 13,744 | 56.5 | 21,560 |
| 25-34 | 38.9 | 25,845 | 40.1 | 22,738 | 41.1 | 22,237 |
| 35-44 | 40.0 | 23,200 | 40.4 | 26,152 | 42.2 | 23,610 |
| 45-54 | 37.1 | 18,495 | 43.0 | 23,446 | 45.8 | 27,887 |
| 55-64 | 26.1 | 10,555 | 31.7 | 13,553 | 34.1 | 16,147 |
| 65 & over | 86.1 | 3,400 | 10.0 | 4,929 | 11.1 | 6,163 |
| Total | 34.6 | 108,930 | 35.2 | 116,075 | 36.7 | 131,747 |
| Index (1950=100.0) | | 100.0 | | 106.5 | | 120.9 |
| **Total Males and Females** | 54.8 | 337,785 | 55.4 | 357,935 | 55.7 | 394,652 |
| Index (1950=100.0) | | 100.0 | | 106.0 | | 116.8 |

Table II-6F

## Projections of Labor Force and Participation Rates, April 1960 and April 1970, By Age and Sex

### Connecticut

| | 1950 | | 1960 | | 1970 | |
|---|---|---|---|---|---|---|
| Age & Sex | LFPR% | Labor Force | LFPR% | Labor Force | LFPR% | Labor Force |
| Males | | | | | | |
| 14-19 | 31.3 | 23,075 | 31.3 | 32,982 | 31.3 | 44,974 |
| 20-24 | 77.4 | 53,760 | 79.5 | 49,521 | 77.9 | 82,672 |
| 25-34 | 93.3 | 150,870 | 95.3 | 135,724 | 95.3 | 150,214 |
| 35-44 | 95.4 | 136,735 | 96.0 | 167,916 | 96.0 | 147,278 |
| 45-54 | 93.6 | 107,085 | 94.7 | 139,576 | 94.7 | 163,290 |
| 55-64 | 86.6 | 84,500 | 88.2 | 92,914 | 88.2 | 114,913 |
| 65 & over | 43.0 | 33,800 | 37.7 | 40,768 | 35.7 | 44,246 |
| Total | 78.0 | 589,825 | 78.0 | 659,401 | 75.7 | 747,587 |
| Index (1950=100.0) | | 100.0 | | 111.8 | | 126.7 |
| Females | | | | | | |
| 14-19 | 28.3 | 20,445 | 27.2 | 27,912 | 26.5 | 36,710 |
| 20-24 | 58.7 | 43,220 | 58.8 | 38,675 | 58.5 | 62,378 |
| 25-34 | 37.8 | 66,455 | 39.0 | 60,454 | 40.0 | 67,352 |
| 35-44 | 39.9 | 61,510 | 43.4 | 81,062 | 45.5 | 75,542 |
| 45-54 | 39.6 | 48,770 | 45.9 | 70,198 | 48.9 | 90,498 |
| 55-64 | 26.8 | 27,430 | 32.4 | 37,244 | 34.9 | 49,584 |
| 65 & over | 10.0 | 8,705 | 10.5 | 14,021 | 11.6 | 18,968 |
| Total | 34.6 | 276,535 | 36.2 | 329,566 | 37.5 | 401,032 |
| Index (1950=100.0) | | 100.0 | | 119.2 | | 145.0 |
| Total Males and Females | 55.7 | 866,360 | 56.3 | 988,967 | 55.8 | 1,148,619 |
| Index (1950=100.0) | | 100.0 | | 114.2 | | 132.6 |

Table II-6G

## NEW ENGLAND LABOR FORCE PARTICIPATION RATES BY AGE AND SEX FOR 1950, 1960 and 1970

| | 1950 | | 1960 | | 1970 | |
|---|---|---|---|---|---|---|
| Age & Sex | LFPR% | Labor Force | LFPR% | Labor Force | LFPR% | Labor Force |
| Males | | | | | | |
| 14-19 | 32.1 | 118,870 | 31.6 | 147,653 | 31.4 | 191,696 |
| 20-24 | 75.6 | 259,070 | 78.0 | 217,193 | 77.3 | 350,853 |
| 25-34 | 90.1 | 641,675 | 93.8 | 567,052 | 93.9 | 575,931 |
| 35-44 | 92.5 | 588,385 | 95.4 | 676,816 | 95.4 | 578,042 |
| 45-54 | 89.5 | 485,665 | 93.1 | 559,410 | 93.5 | 629,911 |
| 55-64 | 82.7 | 373,330 | 86.0 | 392,836 | 86.5 | 444,024 |
| 65 & over | 39.6 | 159,005 | 35.4 | 170,701 | 33.6 | 175,645 |
| Total Males | 76.0 | 2,626,000 | 75.9 | 2,731,661 | 73.8 | 2,946,102 |
| Females | | | | | | |
| 14-19 | 27.5 | 102,245 | 26.8 | 124,123 | 26.3 | 156,763 |
| 20-24 | 54.7 | 192,745 | 54.9 | 160,580 | 54.6 | 248,852 |
| 25-34 | 36.1 | 270,130 | 37.4 | 243,685 | 38.4 | 252,539 |
| 35-44 | 38.1 | 257,730 | 43.5 | 326,972 | 46.7 | 308,205 |
| 45-54 | 38.1 | 221,175 | 44.2 | 286,818 | 47.1 | 341,446 |
| 55-64 | 27.6 | 132,475 | 33.4 | 172,656 | 35.9 | 209,656 |
| 65 & over | 9.0 | 45,555 | 10.5 | 65,838 | 11.6 | 83,845 |
| Total Females | 32.9 | 1,222,055 | 34.9 | 1,380,672 | 36.4 | 1,601,306 |
| Total Labor Force | | | | | | |
| 14-19 | 29.8 | 221,115 | 29.2 | 271,776 | 28.9 | 348,459 |
| 20-24 | 65.0 | 451,815 | 66.2 | 377,773 | 65.9 | 599,705 |
| 25-34 | 62.5 | 911,805 | 64.5 | 810,737 | 65.1 | 828,470 |
| 35-44 | 64.5 | 846,115 | 68.7 | 1,003,788 | 70.1 | 886,247 |
| 45-54 | 62.9 | 706,840 | 67.7 | 846,228 | 69.4 | 971,357 |
| 55-64 | 54.3 | 505,805 | 58.1 | 565,492 | 59.6 | 653,680 |
| 65 & over | 22.6 | 204,560 | 21.3 | 236,539 | 20.8 | 259,490 |
| Total Labor Force | 53.7 | 3,848,055 | 54.4 | 4,112,333 | 54.2 | 4,547,408 |

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